

MSU™

undergraduate research

SYMPOSIUM



SPRING 2023



MISSISSIPPI STATE UNIVERSITY™
UNDERGRADUATE RESEARCH
AND CREATIVE DISCOVERY

april 13-14
colvard student union

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Post a picture of your research on Instagram during the symposium with the hashtag #myMSUresearch and tag @shackoulshonors to enter a swag giveaway! The winner will be announced on Instagram by Wednesday, April 19th.



MISSISSIPPI STATE UNIVERSITY™ UNDERGRADUATE RESEARCH AND CREATIVE DISCOVERY

WELCOME TO THE UNDERGRADUATE RESEARCH SYMPOSIUM!

The Office of Undergraduate Research and Creative Discovery is pleased to host the Spring 2023 Undergraduate Research Symposium and to be a part of the second Mississippi State University Research Week. This symposium is a great way for undergraduate students to showcase their interest and dedication to research activities and for the MSU family to celebrate their engagement, curiosity, and hard work. Thank you for attending!

We believe the support of undergraduate research and creative endeavors for all students to be part of our core mission as an institution of higher learning. Participating in undergraduate research is an exciting way for students to complement their academic studies, paving the way for future intellectual work and exploration.

This event is not possible without the time, effort, and assistance of our dedicated faculty. The student work presented here represents many hours of mentoring students in their research, planning, and analysis. Many faculty have also volunteered their time and expertise to serve as evaluators or judges, so thank you to all of them!

This event is an endeavor that relies on the support and sponsorship by many units, including Shackouls Honors College, the Office of the Provost and Executive Vice President, the Office of Research and Economic Development, the Center for Community-Engaged Learning, the Student Association, the Honor Society of Phi Kappa Phi, and the Graduate School.

We are pleased to also host Special Area Competitions to recognize excellence in scholarship in collaboration with the following partners: Bagley College of Engineering; Center for Community-Engaged Learning; College of Agriculture and Life Sciences and Mississippi Agricultural and Forestry Experiment Station; College of Education; College of Forest Resources and Forest and Wildlife Research Center; Data Science Program; Department of Agricultural and Biological Engineering and Department of Comparative Biomedical Sciences; Department of Food Science, Nutrition, and Health Promotion; Department of Kinesiology; the Graduate School; Mississippi State Institute for the Humanities, the Shackouls Honors College; and Theta Tau Professional Engineering Fraternity.

We are delighted that you have joined us today to peruse the accomplishments of our young researchers! We hope you learn much from the diversity of fascinating research activities underway at MSU. Enjoy!

Anastasia D. Elder, Ph.D.

Associate Dean, Shackouls Honors College

Director, Office of Undergraduate Research & Creative Discovery

**AT MISSISSIPPI STATE, WE BELIEVE IN
THE TRANSFORMATIVE POTENTIAL OF
UNIVERSITY-BASED RESEARCH.**

**WE ARE PROUD OF OUR UNDERGRADUATE
RESEARCHERS AND THE INCREDIBLE
ACCOMPLISHMENTS ON DISPLAY AT THIS
SYMPOSIUM.**

**YOUR RESEARCH MATTERS, AND WE
CAN'T WAIT TO SEE WHERE IT TAKES
YOU.**

**HAIL STATE!
DR. JULIE JORDAN
VICE PRESIDENT FOR RESEARCH
AND ECONOMIC DEVELOPMENT**

TAKING CARE OF WHAT MATTERS



MISSISSIPPI STATE UNIVERSITY™
OFFICE OF RESEARCH AND
ECONOMIC DEVELOPMENT

@MaroonResearch





MISSISSIPPI STATE
UNIVERSITY™

Mississippi State University: Our State's Land-Grant Research Flagship

We are honored to welcome you to Mississippi State University's Spring 2022 Undergraduate Research Symposium. Undergraduate students are an integral part of the multi-faceted research underway at Mississippi State.

Our faculty, staff, and students are conducting fundamental to applied research that provide innovative advancements, creative works, and new scholarship that address a range of pressing needs. As a result of this work, MSU is the leading institution in our state for research, which is a direct result of our embracing the land-grant mission. Strengths across all colleges and research centers have led to our institution being categorized by the Carnegie Foundation as a "very high research activity" institution. The Carnegie Foundation has also recognized Mississippi State with its Community Engagement Classification.

Pursuing research opportunities is a critical part of academic life on our campus, and our students are recognized for their commitment to discovery, creation, and exploration beyond the classroom. We are pleased that members of our faculty are dedicated to providing undergraduates with meaningful roles in the overall research enterprise, and promoting interdisciplinary research as an important component of scholarly activity.

Undergraduate research gives our students opportunities to apply classroom knowledge to new areas of interest and helps them develop skills, collaborate with faculty and peers, and gain confidence. It is exciting to see the results of their efforts on display at today's symposium.

Again, welcome to the symposium, and thank you for your contributions to and interest in research at Mississippi State University.

David R. Shaw, Ph.D.
Provost and Executive Vice President



Student Leadership and Community Engagement (SLCE) is home to the Center for Community-Engaged Learning, Maroon Volunteer Center, and Student Leadership Programs. SLCE's mission is to transform experiences through leadership education and community engagement.

STUDENT LEADERSHIP

- Day One Leadership Program

Day One is for incoming first-year students who want to engage in meaningful service-learning projects while enhancing their leadership styles through interactive classroom settings. Day One promotes a successful transition to campus, both academically and personally, from Day One!

- Leadership Dawgs

Our team of leadership educators is available to facilitate a variety of topics through customized, interactive workshops, and training.

- Montgomery Leadership Program

Established in 2006, MLP is a selection-based cohort experience for sophomores, juniors, and seniors. MLP is a multi-semester immersive leadership experience that culminates with a capstone project.



COMMUNITY ENGAGEMENT

- AmeriCorps VISTA

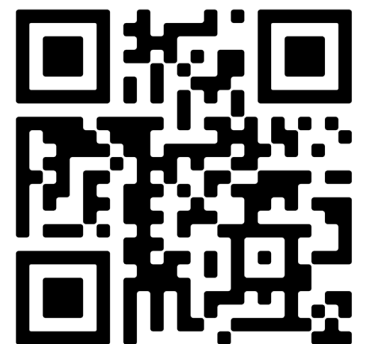
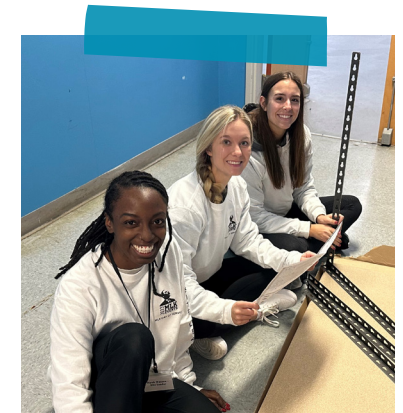
AmeriCorps VISTA members bring their passion and perseverance where the need is greatest: to organizations that help eradicate poverty.

- Center for Community-Engaged Learning

CCEL supports bringing learning to life by engaging students, faculty, staff, and community members in mutually beneficial partnerships that link course learning objectives to real-world issues.

- Maroon Volunteer Center

MVC serves as a conduit to match volunteers with community partners through meaningful service opportunities.





MISSISSIPPI STATE UNIVERSITY™
THE GRADUATE SCHOOL

Dear Students,

Congratulations on your submissions and participation in the Mississippi State University three minute research pitch competition hosted by the Graduate School. This competition is modeled after the Three Minute Thesis (3MT) program, which started fifteen years ago at the Queensland University in Australia as a means of encouraging graduate students to learn how to articulate their research in a 3-minute presentation using one slide and in a vernacular that any individual not in the field of study would walk away with a comprehension and understanding of the field of study being undertaken. This is now a global event with graduate students participating at annual regional, national, and international events.

I commend each of you on your accomplishments. You have shown a commitment to research and creative discovery in your particular fields of study, an achievement worth recognition. As researchers you are gaining valuable experience, whether it be theoretical or experimental, and you are helping to expand the body of knowledge in your field. These experiences can provide glimpses into the world of post-baccalaureate studies and can be beneficial when it comes time to apply for admission to graduate school. I hope that when the time comes you will consider continuing your studies here at Mississippi State University. I assure you your work is being noticed. You should all be very proud of what you have accomplished thus far in your academic careers.

Wishing you all every success in the three minute research pitch competition and with your future scholarly endeavors.

Best regards,
Peter

Peter Ryan, Ph.D., Professor
Executive Vice Provost for Academic Affairs
and Dean of the Graduate School
Mississippi State University

THE HONOR SOCIETY OF PHI KAPPA PHI

Chapter 060
Mississippi State University
Mississippi State, MS 39762

23rd March, 2023

RE: The Undergraduate Research Symposium – Spring 2023



Dear Undergraduate Research Symposium Participants:

The Honor Society of Phi Kappa Phi (PKP) has a long and distinguished history. Currently, there are over 300 chapters of PKP scattered all across the world, from Maine to Hawaii and the Philippines, and from Alaska to Puerto Rico and beyond. During the 1996 – 97 academic year, PKP celebrated the 100th anniversary of the founding of The Honor Society of Phi Kappa Phi, and we are now in the second century of its recognition of- and service to - learning. The MSU chapter celebrated its 70th year of membership in 2021 and consists of 798 active members at present. PKP invites only the highest achieving students from across all disciplines to join this prestigious society and induct new members each spring and fall into the Honor Society. Due to PKP's prestigious recognition and support of learning, the MSU Chapter is proud to also financially support the Spring 2023 Undergraduate Research Symposium at Mississippi State University. As Chapter President, I am honored that Phi Kappa Phi has been asked and is able to support this event as I have tremendous respect for undergraduate research at MSU. This symposium displays the importance of research for success as a student and beyond! Undergraduate research meets a very important criteria of ensuring that every student engages in some form of experiential learning while attending the university.

Thank you for all you do to support undergraduate research opportunities at Mississippi State University,

Respectfully,

A handwritten signature in red ink that reads "Peter L. Ryan".

Peter L. Ryan, PhD, MSU PKP Chapter President

Peter Ryan
President
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MS State, MS
39762

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pkp@org.msstate.edu



MISSISSIPPI STATE UNIVERSITY™ STUDENT ASSOCIATION

The MSU Student Association is proud to sponsor this year's Undergraduate Research Symposium. We fully recognize Mississippi State University's reputation and impact as a top-tier research institution. Committed to ensuring that MSU students get the most out of their time here, we are happy to help them present their undergraduate research, providing them valuable experience and growing their own impact.



Theta Tau Professional Engineering Fraternity is a co-ed student organization that promotes service, professional development, and brotherhood. Our members are a diverse group from every major in the Bagley College of Engineering, and we strive to become the engineering leaders of the future. We are excited to support an individual in this year's research symposium to receive the Tomorrow Builder Award, which aims to recognize an engineering undergraduate student who uses their skills and research to help solve complex problems of critical importance to society.

THE OFFICE OF PRESTIGIOUS EXTERNAL SCHOLARSHIPS



The Office of Prestigious External Scholarships mentors all Mississippi State University students who apply for national and international scholarships, fellowships, and awards. We work with students to find scholarships that fit their academic and professional aspirations and we help students develop competitive, compelling applications.

Each year, we work with dozens of Mississippi State University students and alumni from a wide variety of backgrounds, areas of study, and interests; helping them to not only develop strong application to their desired scholarships and fellowships, but also to craft strong personal narratives which can be applied beyond external scholarship applications.

Since the office's inception in 2012, Mississippi State has had a Rhodes Scholar, a Gates Cambridge Scholar, three Truman Scholars, nine Fulbright scholars, four Boren scholars, nine Astronaut scholars, six PPIA JSI winners, eight Goldwater Scholars and more!

UNDERGRADUATE/ NATIONAL

- Astronaut Scholarship
- Goldwater Scholarship
- Udall Undergraduate Scholarship
- Public Policy and International Affairs Junior Summer Institute
- Humanity in Action Fellowship
- Hollings NOAA Scholarship

INTERNATIONAL

- Fulbright U.S. Student Awards
- Fulbright U.K. Summer Institute
- Boren Awards
- Critical Language Scholarship
- DAAD - Rise
- Voyager Scholarship

GRADUATE SCHOOL

- Knight-Hennessy Scholar Program
- Truman Scholarship
- Rhodes Scholarship
- Gates-Cambridge Scholarship
- Marshall Scholarship
- Mitchell Scholarship
- Churchill Scholarship
- Rangel Fellowship

**ARE YOU
INTERESTED IN
APPLYING TO AN
EXTERNAL
SCHOLARSHIP?
SCHEDULE A
MEETING!**



For appointments regarding specific scholarships, application processes, or editing of polished essays, please contact Dr. David Hoffman, Director of the OPES.

UNDERGRADUATE RESEARCH SYMPOSIUM SCHEDULE

Spring 2023

Thursday, April 13th

Session 1 - Physical Sciences & Engineering		
TIME	EVENT	LOCATION
9:00 a.m. - 9:30 a.m.	Project Check In	Foster Ballroom, Colvard Student Union Second Floor
9:30 a.m.- 10:00 a.m.	Student Viewing of Other Posters <i>No project evaluations at this time</i>	
10:00 a.m. - 11:30 a.m.	Poster Session	
Session 2 - Arts & Humanities (Posters) and Social Sciences		
TIME	EVENT	LOCATION
1:00 p.m. - 1:30 p.m.	Project Check In	Foster Ballroom, Colvard Student Union Second Floor
1:30 p.m. - 2:00 p.m.	Presenter Viewing of Other Posters <i>No project evaluations at this time</i>	
2:00 p.m. - 3:30 p.m.	Poster Session	
Session 2 - Arts & Humanities (Oral Presentations)		
TIME	EVENT	LOCATION
1:00 p.m.	Project Check In	Fowlkes Auditorium, Colvard Student Union Third Floor
1:30 p.m.	Group I Presentations <i>See separate event schedule</i>	
2:45 p.m.	Group II Presentations	

Friday, April 14th

Session 3 - Biological Sciences & Engineering		
TIME	EVENT	LOCATION
9:00 a.m. - 9:30 a.m.	Project Check In	Foster Ballroom, Colvard Student Union Second Floor
9:30 a.m.- 10:00 a.m.	Presenter Viewing of Other Posters <i>No project evaluations at this time</i>	
10:00 a.m. - 11:30 a.m.	Poster Session	
Session 4 - 3Minute Research Pitch		
1:30 p.m.	3Minute Research Pitch Competition, Hosted by The Graduate School <i>See separate event schedule</i>	Dawg House, Colvard Student Union First Floor

ARTS & HUMANITIES ORAL PRESENTATION SCHEDULE

Fowlkes Auditorium, Colvard Student Union

Thursday, April 13th 1:30 p.m.

Event Schedule

1:00 p.m. Group I Check In

1:30p.m. Group I Presentations

Bryan Nguyen (53) Insight into a Composer's Process – "Hymn for Northern Waters"
Juliet Buckholdt (45) Picket Fences: How Alphabets Influence Design and Identity
Trisha Harjono (46) Forming a Contemporary Identity with Traditional Techniques: Identity Exploration through Digital and Tactile Processes of Screen Printing and Batik
David Heson (47) The Domestic Experience of Italian Women in the Anti-Fascist Resistance During 1943-1945
Annie Kirkpatrick (48) Can I Get An Amen: The Role of the Black Church in the Civil Rights Movement

2:30 p.m. Group II Check In

2:45 p.m. Group II Presentations

Kathryn McArthur (49) An Exploration of Mozart's Clarinet Concerto K. 622 in A Major
Anne Louise Phillips (50) Forgiveness in The Winter's Tale and The Gap of Time
Rachel Sampson (51) Stylistic Analysis: Saint Peter's Façade Explored
JaKara Singleton (52) World Building: Exploring the Didactic Relationship Between Reality and Video Games.

3MINUTE RESESARCH PITCH

Dawg House, Colvard Student Union

Friday, April 14th 1:30 p.m.

A competition that challenges undergraduate students to present a compelling verbal presentation of their research topic and its significance in just three minutes. A presentation schedule will be available at the event.

Hosted by The Graduate School at Mississippi State University.

STUDENT PRESENTERS

NAME	RESEARCH CATEGORY	PROJECT NUMBER
James Akin	Physical Science and Engineering	001
McKenna Alden	Physical Science and Engineering	002
Gracie Benefield	Physical Science and Engineering	003
Carter Berry	Physical Science and Engineering	004
Jennifer Bittner	Physical Science and Engineering	005
Nicole Busby	Physical Science and Engineering	006
Kari Chamberlain	Physical Science and Engineering	007
Minjae Cho	Physical Science and Engineering	008
Dalton Crawley	Physical Science and Engineering	009
Jane Alice Dill	Physical Science and Engineering	010
Bonnie Dutra	Physical Science and Engineering	011
Reyki Garcia	Physical Science and Engineering	012
Charlie Gautier	Physical Science and Engineering	013
Finnis Ginder	Physical Science and Engineering	014
Gabriela Gomez	Physical Science and Engineering	015
Surabhi Gupta	Physical Science and Engineering	016
Leah Hammons	Physical Science and Engineering	017
Clark Hensley	Physical Science and Engineering	018
David Heson	Physical Science and Engineering	019
Oliver Higginbotham	Physical Science and Engineering	020
Luca Hoffmann	Physical Science and Engineering	021
Hannah Hyland	Physical Science and Engineering	022
Matthew Jiles	Physical Science and Engineering	023
Kennedy Keyes	Physical Science and Engineering	024
Leon Koehler	Physical Science and Engineering	025
Jackson Koloc	Physical Science and Engineering	026
Will Laird	Physical Science and Engineering	027
Shreenithi Lakshminarayanan	Physical Science and Engineering	028
Kyle Lindsey	Physical Science and Engineering	029
Mallory Mott	Physical Science and Engineering	030
Andie Nanney	Physical Science and Engineering	031
Shanti Nepali	Physical Science and Engineering	032
Mary Grace Paganucci	Physical Science and Engineering	033
Jared Pish	Physical Science and Engineering	034
Dylan Randall	Physical Science and Engineering	035
Stephanie Ressel	Physical Science and Engineering	036
Sidney Sansing	Physical Science and Engineering	037
Gavin Seiler	Physical Science and Engineering	038
William Shy	Physical Science and Engineering	039
Owen Smith	Physical Science and Engineering	040
Evan Tharpe	Physical Science and Engineering	041
Timothy Usey	Physical Science and Engineering	042
Jacob Witcher	Physical Science and Engineering	043

NAME	RESEARCH CATEGORY	PROJECT NUMBER
Justin Yee	Physical Science and Engineering	044
Juliet Buckholdt	Humanities and Arts	045
Trisha Harjono	Humanities and Arts	046
David Heson	Humanities and Arts	047
Annie Kirkpatrick	Humanities and Arts	048
Kathryn McArthur	Humanities and Arts	049
Anne Louise Phillips	Humanities and Arts	050
Rachel Sampson	Humanities and Arts	051
JaKara Singleton	Humanities and Arts	052
Bryan Nguyen	Humanities and Arts	053
Elisa Castañeda	Humanities and Arts	054
Oliver Coleman	Humanities and Arts	055
Madeline Easter	Humanities and Arts	056
Jacqueline Enriquez	Humanities and Arts	057
Garrett Harpole	Humanities and Arts	058
Arturo Hernandez	Humanities and Arts	059
Nathan Mosley	Humanities and Arts	060
Sofia Nail	Humanities and Arts	061
Andrew Nichols	Humanities and Arts	062
Ellen Overstreet	Humanities and Arts	063
Evelyn Ramirez	Humanities and Arts	064
Jason Saucier	Humanities and Arts	065
Karter Wilbert	Humanities and Arts	066
Kathryn Kairshner	Social Sciences	067
Rachel Adair	Social Sciences	068
Carly Ferrell	Social Sciences	069
Reagan Adams	Social Sciences	070
Addison All	Social Sciences	071
Laura Alvarez Rios	Social Sciences	072
Laughlin Aschenbrenner	Social Sciences	073
Catherine Authement	Social Sciences	074
Addison Black	Social Sciences	075
Greyson Bogle	Social Sciences	076
Claire Borel	Social Sciences	077
Mary Charles Bounds	Social Sciences	078
Kayla Bowen	Social Sciences	079
Lucy Brake	Social Sciences	080
Jada Brinner	Social Sciences	081
Laura Chapman	Social Sciences	082
Garry Craddock	Social Sciences	083
Caroline Crawford	Social Sciences	084
Mamie Cupit	Social Sciences	085
Alexandria Davis	Social Sciences	086
Amelia Driggers	Social Sciences	087
Evelyn DuBose-Schmitt	Social Sciences	088

NAME	RESEARCH CATEGORY	PROJECT NUMBER
Whitney Duncan	Social Sciences	089
Whitney Duncan	Social Sciences	090
Genevieve Eaton	Social Sciences	091
Grayson Edwards	Social Sciences	092
Emma Farnlacher	Social Sciences	093
Caitlyn Fischtziur	Social Sciences	094
Anna Gandy	Social Sciences	095
Sophia Garcia	Social Sciences	096
Summer Henry	Social Sciences	097
Marilee Hensley	Social Sciences	098
Mikayla Herndon	Social Sciences	099
Allison Hill	Social Sciences	100
Allison (Amber) Hilliard	Social Sciences	101
Arielle Hooper	Social Sciences	102
Jackson Horton	Social Sciences	103
Deja Howard	Social Sciences	104
Julianna Hynes	Social Sciences	105
Landry Jones	Social Sciences	106
Tyreek Jones	Social Sciences	107
Khaoula Kamal	Social Sciences	108
Kennedy Kellen	Social Sciences	109
Laura Grace King	Social Sciences	110
Lauren LeBlanc	Social Sciences	111
Katy Mahaffey	Social Sciences	112
Hannah Mann	Social Sciences	113
Abigail Martin	Social Sciences	114
Grace May	Social Sciences	115
Cameron McClinton	Social Sciences	116
Jennifer McLemore	Social Sciences	117
Allie Middleton	Social Sciences	118
Julie Anne Miller	Social Sciences	119
Grace Mixon	Social Sciences	120
Josie Nasekos	Social Sciences	121
Lauren Nichols	Social Sciences	122
Ashley O'Donnell	Social Sciences	123
Sadie Ogletree	Social Sciences	124
Camden Patterson	Social Sciences	125
MacKenzie Paul	Social Sciences	126
MacKenzie Paul	Social Sciences	127
K'Lee Pittman	Social Sciences	128
Sarah Rendon	Social Sciences	129
Cameron Renfrow	Social Sciences	130
Nyia Sawyer	Social Sciences	131
Hartleigh Schambeau	Social Sciences	132
Zachary Shike	Social Sciences	133

NAME	RESEARCH CATEGORY	PROJECT NUMBER
Jessie Sloan	Social Sciences	134
Makayla Smith	Social Sciences	135
Adelle Smith	Social Sciences	136
Katherine Snell	Social Sciences	137
Mary Grace Stewart	Social Sciences	138
Samuel Stewart	Social Sciences	139
Anna Catherine Strong	Social Sciences	140
Meghan Thompson	Social Sciences	141
Davie Townes	Social Sciences	142
Muneebah Umar	Social Sciences	143
Matilyn Walden	Social Sciences	144
Mary Marshall Waller	Social Sciences	145
Jeremy Wright	Social Sciences	146
Michelle Yankelevich	Social Sciences	147
Gracie Young	Social Sciences	148
Collin Aupied	Biological Sciences and Engineering	149
Leslie Azwell	Biological Sciences and Engineering	150
Morgan Bailey	Biological Sciences and Engineering	151
Audrey Bales	Biological Sciences and Engineering	152
Zoe Bass	Biological Sciences and Engineering	153
Breelyn Bigbee	Biological Sciences and Engineering	154
Taylor Blaise	Biological Sciences and Engineering	155
Quentin Boccaleri	Biological Sciences and Engineering	156
Hannah Brasher	Biological Sciences and Engineering	157
Austen Breland	Biological Sciences and Engineering	158
Sarah Broadway	Biological Sciences and Engineering	159
Olivia Burdine	Biological Sciences and Engineering	160
Emily Callender	Biological Sciences and Engineering	161
Sydni Carter	Biological Sciences and Engineering	162
Maggie Chamberlain	Biological Sciences and Engineering	163
Meng Xiang Chen	Biological Sciences and Engineering	164
Zijie Chen	Biological Sciences and Engineering	165
Curtis Coleman	Biological Sciences and Engineering	166
Rosalynn Corzine	Biological Sciences and Engineering	167
Elizabeth Cowan	Biological Sciences and Engineering	168
Leon Doan	Biological Sciences and Engineering	169
Brooke Dominici	Biological Sciences and Engineering	170
Olivia Douell	Biological Sciences and Engineering	171
Baylor Doughty	Biological Sciences and Engineering	172
Reese Dunne	Biological Sciences and Engineering	173
Madison Eisenhuth	Biological Sciences and Engineering	174
Jack Fair	Biological Sciences and Engineering	175
Brayden Farmer	Biological Sciences and Engineering	176
James Feduccia	Biological Sciences and Engineering	177
Darrock Flynn	Biological Sciences and Engineering	178

NAME	RESEARCH CATEGORY	PROJECT NUMBER
Connor Foley	Biological Sciences and Engineering	179
Makenna Foster	Biological Sciences and Engineering	180
Cameron Fowler	Biological Sciences and Engineering	181
Sheraden Gagliano	Biological Sciences and Engineering	182
Andrea Gonzalez Lopez	Biological Sciences and Engineering	183
Claire Green	Biological Sciences and Engineering	184
Zeb Green	Biological Sciences and Engineering	185
Piper Guilliams	Biological Sciences and Engineering	186
April Guo-Yue	Biological Sciences and Engineering	187
Caroline Haley	Biological Sciences and Engineering	188
Maya Harlow	Biological Sciences and Engineering	189
Sallen Hatten	Biological Sciences and Engineering	190
Landon Hawk	Biological Sciences and Engineering	191
McCaa Headley	Biological Sciences and Engineering	192
Trevor Holland	Biological Sciences and Engineering	193
Ariory Hood	Biological Sciences and Engineering	194
Ainsley Jessup	Biological Sciences and Engineering	195
Xinyan Jian	Biological Sciences and Engineering	196
Sophie Jones	Biological Sciences and Engineering	197
Kristian Jones	Biological Sciences and Engineering	198
Erin Jones	Biological Sciences and Engineering	199
Tanner Jones	Biological Sciences and Engineering	200
Catherine Kalmbach	Biological Sciences and Engineering	201
Jennifer Kemp	Biological Sciences and Engineering	202
Breann Keowen	Biological Sciences and Engineering	203
Anamica Khadgi	Biological Sciences and Engineering	204
Prabesh Khanal	Biological Sciences and Engineering	205
Meg Kilgore	Biological Sciences and Engineering	206
Tanner Laird	Biological Sciences and Engineering	207
Anna Landrum	Biological Sciences and Engineering	208
Emily Little	Biological Sciences and Engineering	209
Aysha Mann	Biological Sciences and Engineering	210
Wilson Martinez Diaz	Biological Sciences and Engineering	211
Malori Masaitis	Biological Sciences and Engineering	212
Adriana Mays	Biological Sciences and Engineering	213
Kendall McKinnon	Biological Sciences and Engineering	214
Madeline McKnight	Biological Sciences and Engineering	215
Abigail Mechatto	Biological Sciences and Engineering	216
Hannah Miller	Biological Sciences and Engineering	217
Kala Morris	Biological Sciences and Engineering	218
Grant Norman	Biological Sciences and Engineering	219
Katie Norris	Biological Sciences and Engineering	220
Emma Palmer	Biological Sciences and Engineering	221
Xavier Person	Biological Sciences and Engineering	222
Morgan Peters	Biological Sciences and Engineering	223

NAME	RESEARCH CATEGORY	PROJECT NUMBER
Grant Peterson	Biological Sciences and Engineering	224
Maggie Phillips	Biological Sciences and Engineering	225
Jasmine Rillen	Biological Sciences and Engineering	226
Alexa Rogers	Biological Sciences and Engineering	227
Angela Ross	Biological Sciences and Engineering	228
Bailey Roux	Biological Sciences and Engineering	229
Thomas Rovery	Biological Sciences and Engineering	230
Sophia Ruckman	Biological Sciences and Engineering	231
Ariadna Daniela Santos Chaves	Biological Sciences and Engineering	232
Clare Seo	Biological Sciences and Engineering	233
Collin Sharp	Biological Sciences and Engineering	234
Abigail Shaw	Biological Sciences and Engineering	235
Austin Simpson	Biological Sciences and Engineering	236
Eli Smart	Biological Sciences and Engineering	237
Sage Smith	Biological Sciences and Engineering	238
Susan Sotak	Biological Sciences and Engineering	239
Alex Speak	Biological Sciences and Engineering	240
Agatha Taquino	Biological Sciences and Engineering	241
Annamarie Thompson	Biological Sciences and Engineering	242
Charlotte Thompson	Biological Sciences and Engineering	243
Mary Tingle	Biological Sciences and Engineering	244
Sarah Turnipseed	Biological Sciences and Engineering	245
Dustin Van	Biological Sciences and Engineering	246
Emma Van Epps	Biological Sciences and Engineering	247
Nate Venarske	Biological Sciences and Engineering	248
Judy Vu	Biological Sciences and Engineering	249
Lynn Wade	Biological Sciences and Engineering	250
Jordan Walters	Biological Sciences and Engineering	251
Emily White	Biological Sciences and Engineering	252
Jordan Wilburn	Biological Sciences and Engineering	253
Alyssa Williams	Biological Sciences and Engineering	254
Emma Willis	Biological Sciences and Engineering	255
Jamarah Wright	Biological Sciences and Engineering	256

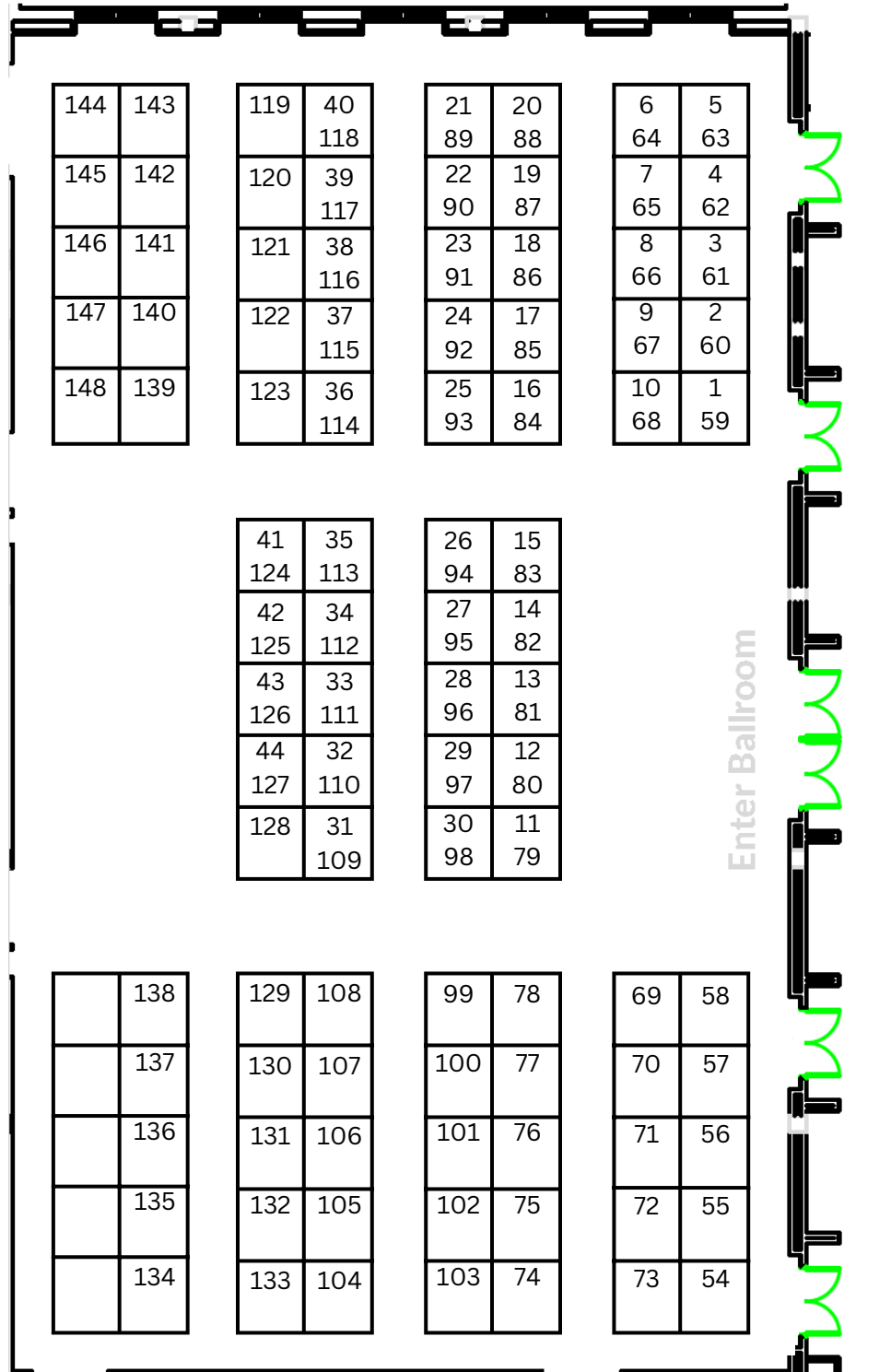
SYMPOSIUM POSTER MAP SESSIONS 1 & 2

Foster Ballroom, Colvard Student Union
Mississippi State University

Physical Sciences & Engineering (1 - 44)

Humanities & Arts (54 - 66)

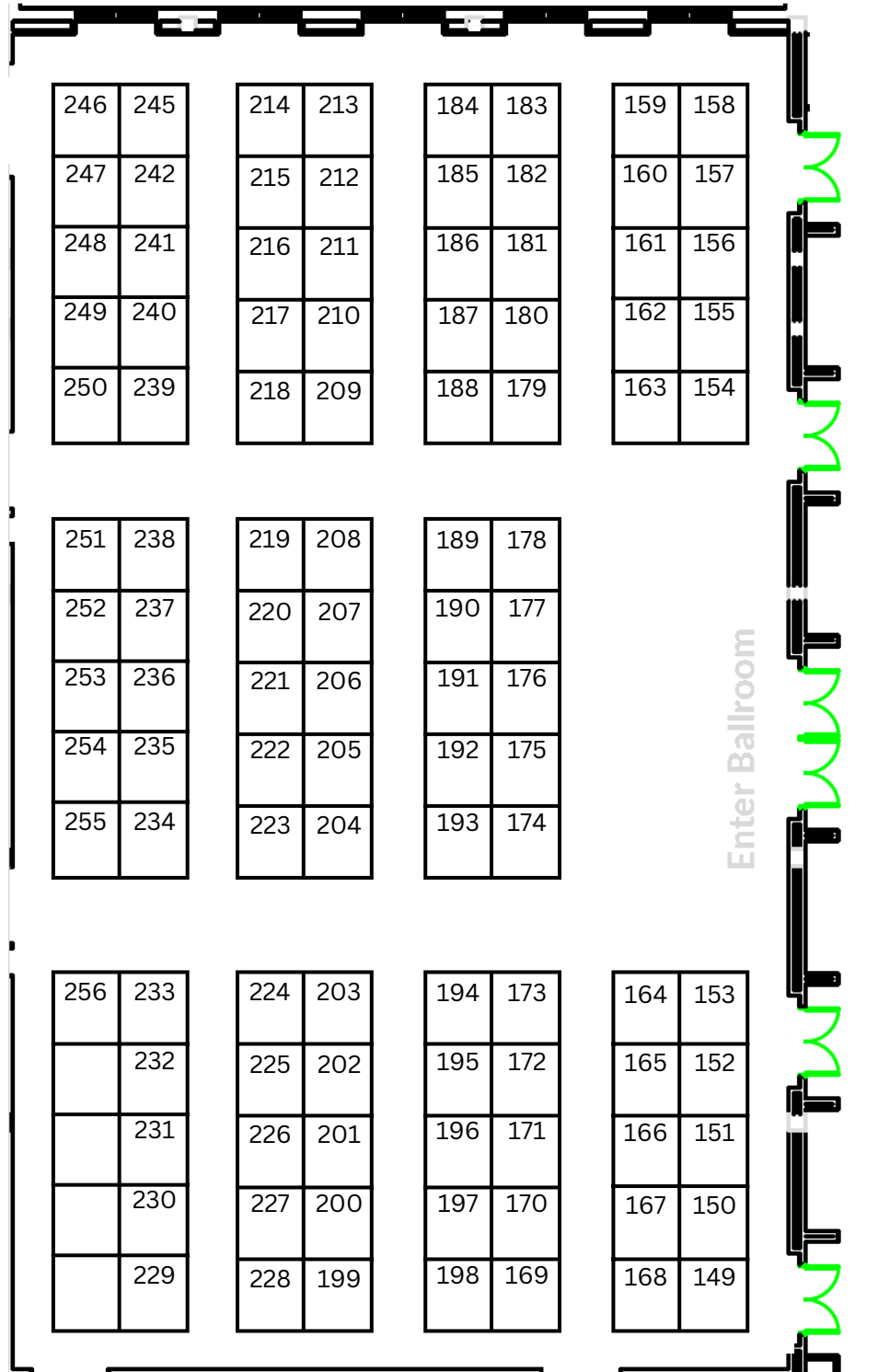
Social Sciences (67 - 148)



SYMPOSIUM POSTER MAP SESSION 3

Foster Ballroom, Colvard Student Union
Mississippi State University

Biological Sciences & Engineering (149 - 256)



ABSTRACTS

68

Name: Adair, Rachel

Major: Business Economics

Faculty Advisor: Holli Seitz, Communication

Funding: ORED Undergraduate Research Program

Using Diffusion of Innovation Theory Attributes to Predict Intention to Click, Make, and Share HappyHealthy Recipes on Facebook

Background: HappyHealthy is a social marketing campaign that aims to increase fruit and vegetable consumption among Supplemental Nutrition Assistance Program recipients. In order to increase HappyHealthy recipe adoption, there is a need to understand the attributes of a recipe that predict intention to click recipe links, make recipes, or share social media posts. Objectives: The primary objective of this study was to identify Diffusion of Innovation (DOI) (Rogers, 1962) attributes that predict intention to click, make, or share HappyHealthy recipes on Facebook. Methods: In a web-based survey hosted by Qualtrics, 812 US adults evaluated one randomly selected HappyHealthy recipe social media post from a pool of 45 recipes. Participants rated their likelihood of clicking the link to see the full recipe, making the recipe, and sharing the recipe, each measured on a scale from 1 (not at all likely) to 10 (extremely likely). Participants also responded to items measuring relative advantage ($r=.5$, $p<.01$), compatibility ($\alpha=.72$), complexity ($\alpha=.64$), and trialability of the recipe on a scale from 1 to 5, where 5 indicates a higher value. Linear regression analyses were used to predict the effect of DOI attributes on the three outcome measures (intention to click, make, and share). Results: Relative advantage and compatibility were significant predictors of intention to click the link to view the full recipe. Relative advantage and compatibility were also significant predictors of intention to make the recipe. Finally, relative advantage and compatibility were significant predictors of intention to share the recipe. Conclusion: Relative advantage and compatibility are significant predictors of intention to click, make, and share HappyHealthy Facebook recipes. Thus, healthy recipes that are perceived as being higher in relative advantage (i.e., quicker and easier) and compatibility (i.e., fitting the user's current cooking style) may be more likely to be adopted.

70

Name: Adams, Raegan

Major: Kinesiology

Faculty Advisor: Chih-Chia Chen, Kinesiology

Training with Badminton Shuttle Time Starter Lessons: What is working for Young Adults with Intellectual Disabilities?

PURPOSE/ AIM: Physical activity has been proposed as a context to foster healthy development and reduce the risk of many chronic problems. Badminton has become one of the most popular sports in the world. Thus, this study was aimed at evaluating the badminton lessons on health and wellness in young adults with intellectual disabilities (ID). METHODS: The total of fourteen participants with ID (10 males and 4 females, aged 19-26) with little or no experience in badminton participated in the current study. Badminton World Federation (BWF) Shuttle Time Starter Lessons were selected for the training curriculum. Participants with ID practiced together with their typical peers for 50-minute in each session, twice a week, for 10 lessons. Resting heart rate (RHR), blood pressure, waist circumference, 6-minute walk test (6MWT) and Special Olympics Individual Badminton Skills test were recorded before and after the program. RESULTS: A Wilcoxon signed-rank test was conducted to compare the differences in each measure. RHR was significantly reduced ($p = 0.04$). Participants also walked longer distances in the 6MWT ($p = 0.006$) and performed better in their basic badminton skills ($p = 0.005$). CONCLUSION/ IMPLICATIONS: Training with BWF Shuttle Time Lessons may improve cardiovascular function and motor performance in adults with ID. In addition, participants expressed enjoyment while practicing with typical peers. The inclusion might also motivate their participation. Future research is still needed with larger sample size and additional control group to explore the benefits of badminton sports for individuals with ID.

1

Name: Akin, James

Major: Animal and Dairy Science

Faculty Advisor: Joseph Emerson, Chemistry

Co-Author(s): S. Erfan Masaeli, Mohsen Teimouri, Bhupendra Adhikari, Mahshid Attarroshan, Selvam Raju

Sodium Trifluoroacetate mediated Copper-Catalyzed aza-Michael addition of α,β -unsaturated olefins with aromatic amines

We present a sodium trifluoroacetate ($\text{CF}_3\text{CO}_2\text{Na}$) mediated copper-catalyzed aza-Michael addition of aromatic amines with activated olefins in the presence of environmentally friendly solvent under mild reaction conditions. This simplistic protocol employs a copper catalyst (10 mol%) and water as solvent. This transformation occurs precisely with aromatic substituted amines containing both

electron-donating (EDG) and electron-withdrawing (EWG) groups. A broad range of substrates were tested under the optimized conditions, which are producing good to moderated yields.

2

Name: Alden, McKenna

Major: Geoscience

Faculty Advisor: Adam Skarke, Geosciences

Co-Author(s): Jake Freeman

Funding: Shackouls Honors College Research Fellowship

High-Resolution Mapping of Deep-Sea Benthic Environments Through Orthorectification of Oblique ROV Video Data

The development of remotely operated vehicles (ROVs) has enabled extensive research in deep-sea benthic environments and resulted in the generation of vast quantities of publicly archived ROV video data. These video data are potentially an immensely valuable resource for the oceanographic research community. However, for scientists not directly involved in their collection, the amount time and effort required to review tens to hundreds of hours of video in order to determine its potential value to their research objectives is often prohibitive. Accordingly, the goal of this project was to develop a system to generate geospatially referenced, high-resolution seafloor image maps through orthorectification of commonly collected oblique ROV video data. As a proof of concept, a seafloor map of the Veatch Canyon methane seep site was generated with video data acquired during an exploratory dive of the ROV Deep Discoverer aboard NOAA Ship *Okeanos Explorer* (EX1304L1 Dive 13). Specifically, oblique ROV camera video frames were extracted and then orthorectified in a single map using associated vehicle position and attitude records. The geospatial representation of seafloor features in the resulting map was evaluated relative to that of coincident spatial datasets collected by the autonomous underwater vehicle Sentry including side scan sonar, multibeam bathymetry, multibeam backscatter, and normal oriented still camera photomosaic surveys. Results indicate that the presented ROV video data orthorectification approach yields maps that are consistent with those surveys in terms of geospatial positioning of seafloor features and, in some cases, of higher resolution. Maps resulting from the presented method will enable end users to rapidly understand what environmental features were observed during an ROV dive as well as the spatial relationship between them. Standardized mapping of new and archived ROV video data in this manner holds great potential to enhance accessibility and utilization of those data by the broader oceanographic research community.

71

Name: All, Addison

Major: Psychology

Faculty Advisor: Hilary L. DeShong, Psychology

Co-Author(s): Mikayla Herndon, Kren Kelley

Personality Traits and Grit: Investigating the potential incremental validity of grit when predicting thwarted belongingness, perceived burdensomeness, and acquired capability.

Grit is predominantly researched as an adaptive personality characteristic associated with academic and occupational success. However, preliminary research highlights grit as a potential risk factor for negative clinical outcomes, such as increased acquired capability for suicide. Research has yet to examine how grit differentially contributes to other interpersonal risk factors for suicide (i.e., thwarted belongingness, perceived burdensomeness). Further, research has yet to examine whether grit contributes to acquired capability above and beyond personality characteristics subsumed within the general Five Factor Model (FFM) of personality, given that previous literature has demonstrated that facets of neuroticism, extraversion, and agreeableness function as risk or protective factors regarding these risk factors. Therefore, the current study examined the incremental validity of grit as a predictor of acquired capability, thwarted belongingness, and perceived burdensomeness above and beyond these FFM facet traits. Data were analyzed from two archival datasets: undergraduate students ($N = 497$) and Amazon Mechanical Turk (MTurk) workers ($N = 434$); This was done to assess the generalizability of findings across each population using a series of hierarchical regressions to assess the incremental validity of grit in predicting thwarted belongingness, perceived burdensomeness, and acquired capability beyond facets of the FFM. Within the MTurk sample, higher levels of grit contributed a marginal degree of variance (<1%) towards decreased thwarted belongingness after accounting for the effects of FFM facets. However, grit did not demonstrate incremental validity in predicting perceived burdensomeness or acquired capability. In the student sample, grit failed to demonstrate incremental validity for all three risk factors. Findings suggest that FFM facets may best account for features of grit previously connected to increased suicide risk. Future research may benefit from thoroughly examining whether characteristics of grit are best accounted for by facet-level traits within the general FFM framework.

72

Name: Alvarez Rios, Laura

Major: Psychology

Faculty Advisor: Mary E. Dozier, Psychology

Exploring the Link between Readiness for Change and Hoarding Symptoms in Rural-Dwelling Older Adults

Hoarding disorder is characterized by difficulty letting go of possessions, compulsive acquisition of new items, and excessive clutter. Low motivation for change is common among individuals with hoarding disorder, and apathy is a contributing factor. The purpose of this study was to examine the associations between perceived motivation for change and hoarding symptoms among community-dwelling older adults. Fifteen older adults enrolled in a pilot treatment study for hoarding disorder completed the University of Rhode Island Change Assessment Scale (URICA) and Apathy Evaluation Scale (AES) during their baseline assessment. Results showed that participants who completed a six-week de-cluttering treatment reported a significantly higher level of readiness for change at the baseline assessment. However, there was no significant change in apathy as assessed using the AES between the baseline and post-treatment assessments. In contrast, there was a statistically significant decrease in reported clutter level from baseline to post-treatment assessment. These findings suggest that the de-cluttering treatment may be effective in promoting readiness for change and reducing clutter level in individuals. This study highlights the importance of fostering motivation for change in interventions for individuals with hoarding disorder, particularly among older adults who may be more susceptible to clutter accumulation. The study also underscores the need to address apathy in the context of hoarding disorder. Further research is needed to explore the long-term effectiveness of de-cluttering treatments and to identify additional factors that may influence motivation for change in individuals with hoarding disorder.

73

Name: Aschenbrenner, Laughlin

Major: Psychology

Faculty Advisor: Hilary L. DeShong, Psychology

Co-Author(s): Kren Kelley

Limited Access to Emotion Regulation Strategies Mediates the Relation Between Vulnerable Narcissism and Suicide Risk

Vulnerable narcissism is characterized by feelings of shame, emptiness, hopelessness, and social withdrawal. Notably, vulnerable narcissism is strongly associated with increased suicide risk, yet limited research exists examining cognitive and affective processes that contribute to the relation between vulnerable narcissism and suicide risk. Recent research suggests emotion dysregulation mediates the relation between vulnerable narcissism and suicide ideation. However, emotion dysregulation is a multifaceted construct and research has yet to identify which specific facets of emotion dysregulation account for the relation between vulnerable narcissism and suicide risk. Therefore, the present study investigated which facets of emotion dysregulation mediate the association between vulnerable narcissism and suicide risk. Participants ($N = 918$) completed measures of vulnerable narcissism, emotion regulation, and suicide risk. Parallel mediation analyses assessed the direct and indirect effects of six emotion dysregulation components on the relation between vulnerable narcissism and suicide risk. Vulnerable narcissism had an indirect effect on suicide risk through limited access to emotion regulation strategies. However, no other facets of emotion dysregulation were associated with heightened suicide risk. Findings suggest that interventions focused on building self-efficacy for learning and engaging in effective emotion regulation strategies may reduce suicide risk relative to other strategies.

149

Name: Aupied, Collin

Major: Biological Sciences

University: Louisiana State University

Faculty Advisor: Bret Elder, Systematics, Ecology and Evolution, LSU

Modeling Predation and Disease Transmission in the Fall Armyworm, *Spodoptera frugiperda* – Healthy Herds and Messy Predation

The Susceptible-Infected-Recovered or SIR model of disease spread uses differential equations to predict and chart out pathogen spread within a population. However, the model only accounts for interactions between a host and its pathogen. Yet, hosts live within a community of organisms where a variety of other interactions take place, such as predation. Using this adaptable model, we examined how predation effects disease spread within a host population. There are two hypotheses associated with predation, the healthy herd and predator spreader hypotheses. The healthy herd hypothesis posits that predation removes infected individuals from the population or decreases population size to a level where disease spread declines; while the predator spreader hypothesis states that messy predation increases the spread of disease within a population. We constructed a SIR-based model that accounts for the effects of predation and parameterized the model using a system where the fall armyworm, *Spodoptera frugiperda*, is the host and its lethal baculovirus serves as the pathogen. We coded the model using the programming language R and analyzed the data to examine how differences in predation either via the healthy herd hypothesis or messy predation affect host population and pathogen dynamics.

74

Name: Authement, Catherine

Major: Criminology

Faculty Advisor: David May, Sociology

Co-Author(s): Hailea Molina

Interviewing Inmates About Family and Finances

A large body of research exists that suggests that incarceration has negative consequences on an individual's family and finances. Nevertheless, there have been few studies that have interviewed currently incarcerated individuals about their financial situation pre, during and anticipated post incarceration. In this research, we interviewed X currently incarcerated individuals to understand their perspectives about these topics. Preliminary results suggest that inmates have difficulty maintaining strong family relationships while incarcerated, often due to embarrassment or shame. Additionally, these individuals often realize that their financial resources are nonexistent and many are concerned about their future given their current financial situation. Implications for policy and research are also discussed. *Authors are listed in alphabetical order

150

Name: Azwell, Leslie

Major: Wildlife, Fisheries & Aquaculture

Faculty Advisor: Mark D. McConnell, Wildlife, Fisheries, and Aquaculture

Funding: College of Forest Resources and Forest and Wildlife Research Center Undergraduate Research Scholars Program

Utilizing Autonomous Recording Units to Monitor Grassland Bird Populations

Grassland birds exhibit greater rates of population decline than any other avian group primarily due to habitat loss and historic land use changes. Monitoring grassland birds requires accurate and reliable population estimates. Monitoring data can help understand population status, trends, and inform management decisions. Human observer point-count surveys are the traditional method for generating this critical data. These surveys are conducted from sunrise until mid-morning during peak calling activity throughout the breeding season. Autonomous recording units (ARU's) have been increasingly used to monitor wildlife, specifically avian species, by passively recording their calls across the landscape. Recent studies suggest that ARU's could be a reliable alternative to traditional point counts. However, the practicality and reliability of ARU's has been speculated in several studies and remains largely ambivalent and species specific. We randomly distributed 14 ARU's on a private farm in West Point, Mississippi that is actively managed for grassland-dependent songbirds. The ARU's ran continuously starting 30 minutes before sunrise and stopping 30 minutes after sunset from April 15 to August 15, 2021. We used Kaleidoscope Pro software to extract and review recordings. We monitored multiple early successional grassland bird species and used Indigo Buntings (*Passerina cyanea*) as a focal species. We found peaks in Indigo Bunting calling activity throughout the breeding season. These peaks are predictable and indicate optimum time frames and detection periods for assessing the population abundance of this species. These results support that ARU's provide a feasible method for conducting breeding bird season surveys in the Southeastern United States. Future research should focus on comparing abundance estimates between ARU's and human surveys to determine future utility in meeting conservation objectives.

151

Name: Bailey, Morgan

Major: Kinesiology

Faculty Advisor: Stamatis Agiovlasis, Kinesiology

Co-Author(s): Brantley K. Ballenger, Maggie Chamberlain

Funding: NIH Grant R15HD098660

Wrist Accelerometer Cut-Points For Measuring Physical Activity And Sedentary Behavior In Adults With Down Syndrome

BACKGROUND: The wrist may be an appropriate site for accelerometer placement for adults with Down syndrome (DS) because it may increase compliance. However, wrist accelerometer output has not been calibrated in adults with DS. This study therefore aimed to develop wrist worn accelerometer cut-points for sedentary behavior and moderate and vigorous physical activity (PA) for adults with DS. **METHODS:** Twenty-three adults with DS (11 men & 12 women; age 34 ± 8 years) performed 18 tasks of daily living each lasting 6 min. Rate of oxygen uptake was measured with portable indirect calorimetry (K5, Cosmed) and expressed as Metabolic Equivalents (METs). Vector Magnitude was determined based on output from a triaxial accelerometer (wGT3X-BT, Actigraph) worn on the non-dominant wrist. Vector Magnitude cut-points for sedentary behavior and moderate (3.0 – 5.99 METs) and vigorous (≥ 6 METs) PA were determined using Receiver Operating Characteristic (ROC) curves. Area under the ROC curve was used to evaluate overall classification performance of the models. Optimal cut-points maximizing sensitivity and specificity were selected based on Youden's index. **RESULTS:** Area under the ROC curve was high for all models: (a) sedentary behavior (0.95; 95% CI: 0.93–0.97); (b) moderate PA (0.86; 95% CI: 0.82 – 0.89); and (c) vigorous PA (0.91; 95% CI: 0.84–0.97). The optimal Vector Magnitude cut-points were: (a) sedentary behavior ≤ 2680 counts-min⁻¹ (sensitivity 0.97; specificity 0.87; Youden's index 0.84); (b) moderate PA ≤ 5013 counts-min⁻¹ (sensitivity 0.81; specificity 0.78; Y-index

0.59); and (c) vigorous PA ≥ 5458 counts \cdot min⁻¹ (sensitivity 1.00; specificity 0.66; Y-index 0.66). CONCLUSION: This study offers DS-specific wrist-based accelerometer cut-points for classifying sedentary behavior and PA intensity in adults with DS. The cut-points appear to have high accuracy. Use of DS-specific cut-points may advance the study of PA and sedentary behavior in adults with DS.

152

Name: Bales, Audrey

Major: Biological Sciences

Faculty Advisor: Andrew Lawton, Biological Sciences

Co-Author(s): Olivia Wehrman, Amber Cook, Kayla Porre

Funding: National Science Foundation

Differential Expansion Drives Cerebellar Folding in Alligator, Chicken and Mouse

The cerebellum has a highly conserved laminar structure across vertebrates. However, it varies dramatically in the amount and pattern of folding across species creating beautiful and diverse structures. In the mouse, folding emerges through the interaction of different tissue-level mechanics. A differential-expansion arising between the rapidly expanding External Granule Layer (EGL) and the inner core of the cerebellum drives folding and controls the folding amount between individuals. Additionally, the thickness of the EGL is predicted to regulate the folding wavelength as thicker layers require more force to fold. However, it is not known if these tissue mechanics are broadly conserved. To investigate if the mechanics observed in the mouse are conserved, we compared the cerebella of the chicken and alligator. In both species, the cerebella have a similar starting geometry and cytological architecture. Yet, the chicken cerebella develop a folded morphology while the alligator remains almost completely unfolded. Therefore, if the tissue mechanics are conserved, the chicken cerebellum should have high levels of differential-expansion and the alligator should have almost none. To test this, we measured the growth ratios between the EGL and the cerebella core during development. Excitingly, we found that in chicken, the growth ratio, and its underlying tissue geometry, produced a differential-expansion; however, in the alligator, the cerebellum showed a balanced expansion throughout development. This demonstrates that differential-expansion is likely highly conserved, and its level may control the severity of folding between species. Preliminary evidence indicates that the thickness of the EGL in the alligator is increased compared with the chicken. This is predicted to work synergistically with the change in differential-expansion to limit the folding in the alligator. Together, these results suggest that these tissue mechanics are likely conserved, and that across vertebrates cerebellar folding emerges from simple growth dynamics and the underlying geometry of the tissue.

153

Name: Bass, Zoe

Major: Biochemistry

Faculty Advisor: Erika Womack, Mississippi State Chemical Laboratory

Co-Author(s): Magan Green

A modified QuEChERS extraction method to determine aflatoxin contamination in French fries

Regulatory monitoring programs to survey harmful compounds exposure to humans are important for food safety, sustainability, and security. Yet, food screening and identification of chemical contaminants in all foods are challenging. Quantitative analytical methods by mass spectrometry (MS) are important to gain a better understanding of these issues. The method, known as the quick, easy, cheap, effective, rugged, and safe (QuEChERS) method for pesticide residues was modified to determine aflatoxin contamination in French fries. Aflatoxin is a class of mycotoxin produced by the fungus, *Aspergillus flavus* that is ubiquitous in nature. Aflatoxin, especially aflatoxin B1, is a carcinogenic compound classified as a group I carcinogen and can be detrimental to animal and human health. Additionally, aflatoxin can result in economic losses through contamination of agricultural commodities. In this research project, we wanted to determine if aflatoxin was present in store-bought frozen and local fast-food French fries. A 2 g sample of French fries was analyzed for aflatoxin B1. Briefly, the QuEChERS extraction method was utilized (50% acetonitrile/water v/v), and the extract was injected by the HPLC-MS/MS to detect and quantify aflatoxin through compound mass analyses. Aflatoxin was non-detectable in all samples. Our results suggest that the QuEChERS extraction method coupled to HPLC analysis indicate potential for aflatoxin screening in human foods. Additionally, these analytical tools for monitoring harmful chemical contaminants in foods is vital for the quality and safety of the human food supply.

3

Name: Benefield, Gracie

Major: Wildlife, Fisheries & Aquaculture

Faculty Advisor: Todd E. Mlsna, Chemistry

Co-Author(s): Prashan M. Rodrigo, Sean Stokes, Charles U. Pittman Jr.

Sorption of Aqueous Uranium (VI) using Magnetite Nanoparticles Dispersed on Douglas fir Biochar

Uranium leaking into the environment can cause harm to humans, animals, and nature. With uranium being leaked without proper treatment, it will eventually be absorbed and put into the biological-geochemical circulation. Magnetite nanoparticles were synthesized on Douglas fir biochar (Fe₃O₄/DFBC) using chemical co-precipitation. Fe₃O₄/DFBC was used here to remediate aqueous uranium (VI) contaminated water. pH 5 was selected as optimized pH due to higher sorption capacity, low iron leaching and closeness to groundwater pH. Sorption equilibriums were reached after 2 min, 1 min, and 30 seconds for 0.1, 1, and 10 mg/L initial aqueous uranium (VI) concentrations, respectively. Sorption was exothermic, and Langmuir capacity was 59.2 mg/g at 25°C. The effect of competitive ions/molecules of magnesium, calcium, lead, carbonate, phosphate, and methylene blue were studied on U(VI) sorption. The effect of biochar particle size and the iron leaching was studied at 100 mg/L initial UO₂²⁺ concentration and the effect of real water matrix and biochar dosage were studied at 5, 50 and 500 mg/L initial UO₂²⁺ concentrations. Continuous-flow-fixed-bed column breakthrough study was carried out 100 mg/L, and maximum capacity was 29.1 mg/g. pH 3 HCl solution was used for column regeneration study. Fe₃O₄/DFBC were characterized by X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), scanning electron microscopy (SEM), and transmission electron microscopy (TEM) after and before laden with U(VI).

4

Name: Berry, Carter

Major: Mechanical Engineering

Faculty Advisor: Ben Xu, Mechanical Engineering

Co-Author(s): Xuefeng Zhang

Funding: BCoE Undergraduate Research Award

3D Printing Hydrogel with Integrated Lignin-Based Fibers using a Coaxial Nozzle

Medical research and training are currently confined to organ donations and tests with animals; this limits the advancement and discovery that occurs in the medical field. Providing artificially created organs and tissues could allow medical professionals to expedite their research and enrich their experimental approaches. 3D bioprinting presents this opportunity. The key difference between 3D bioprinting and typical 3D printing is the material. Hydrogel can be used in 3D bioprinting and is an excellent pathway for the development of tissues and organs. However, hydrogel lacks the mechanical integrity required of a 3D printing material. A small-scale scaffolding in 3D bioprinting would allow the hydrogel to be adequately rigid for additive manufacturing. Lignin fibers have the potential to create a biological support system within the hydrogel. Lignin is a polymer that fills the space between the cell walls of some plants. Therefore, implementing lignin fibers into the hydrogel as it is printed can result in a printed structure with the ability to form its own vasculature. To test this, a coaxial nozzle design is used in the 3D bioprinting process. The coaxial nozzle allows nanocellulose and a chitin suspension to be printed together. The volumetric flow rate of the hydrogel and fibers are precisely controlled by two syringe pumps to manipulate the morphology. The movement speed and direction are created by a modified XY plotter. This allows complete control over the shapes created by the hydrogel. The geometric properties of the resulting structure are then evaluated using ImageJ and other measuring techniques. The results of this research topic prove the feasibility of a 3D printer embedding the lignin-based fibers in the hydrogel. This research will help advance future technological development in manufacturing tissues or organs for medical research.

154

Name: Bigbee, Breelyn

Major: Wildlife, Fisheries & Aquaculture

Faculty Advisor: Sandra Correa, Wildlife, Fisheries and Aquaculture

Co-Author(s): Peter Allen, Esteban Galeano, Fernando Yamamoto,

Funding: College of Agriculture and Life Sciences URSP

Exploring seed dispersal by fish as a recovery mechanism for endangered plants in river floodplains

Seed dispersal by fish is an ancient ecological interaction that likely predated dispersal by other vertebrates in wetlands. Fruit-eating fish could play a crucial role in recovering endangered floodplain plant species. In the Lower Mississippi Alluvial Valley, pondberry is a federally- endangered shrub primarily affected by hydrological modifications that led to fragmentation and seed dispersal limitation. Pondberry, like other floodplain plants, produces relatively small fruits with small seeds. To explore the potential of small fish as seed dispersers of Pondberry and other floodplain plants, we will set a controlled feeding experiment to assess 1) the frequency of seed consumption by fish, 2) mechanical damage to seeds during consumption, and 3) seed viability after passage by fish guts. We will run feeding trials in a fish room using two water circulation systems with 12 tanks each. Fish will be placed individually per tank and fed fruits of common floodplain plants with small seeds (e.g., beautyberry and elderberry) to satiation. Trials will be conducted with single fruit species on fish fasting during the previous 24 hrs. We will feed fruits in the morning and provide a second meal of a commercial ration to ensure proper nutrition. We will siphon feces and collect seeds every 4 hrs for 24 hrs. We will inspect seeds for evidence of damage during consumption and test seed viability using tetrazolium. We will compare the viability of control seeds subjected to waterlogging but not consumed by fish versus those retrieved from fish feces.

5

Name: Bittner, Jennifer

Major: Microbiology

Faculty Advisor: Todd E. Mlsna, Chemistry

Co-Author(s): Beatrice Arwenyo, Prashan M. Rodrigo

Funding: Creekside Environmental Products

Sorption of Copper (II) Using Potassium Hydroxide, Sodium Carbonate, and Sulfuric Acid Modified Douglas fir Biochar

The copper accumulation in the environment results from human activities including, copper in drinking water via corrosion of household plumbing, faucets, and water fixtures as well as other factors such as poor waste management, waste from copper mines, and analytical reagents. Douglas fir biochar (BC) was modified using KOH (KOH/BC), H₂SO₄ (H₂SO₄/BC), and Na₂CO₃ (Na₂CO₃/BC) separately. The point of zero charge for KOH/BC, Na₂CO₃/BC, H₂SO₄/BC, and BC were 8.68, 8.45, 0.71, and 8.40 respectively. Despite higher specific surface area of BC (578.9 m² g⁻¹) and KOH treatment BC (389.3 m² g⁻¹) versus Na₂CO₃ modified biochar (367.9 m² g⁻¹), Na₂CO₃/BC exhibited much better sorption capacity for Cu²⁺ in the aqueous solution. The removal capacities for Cu²⁺ were in the order Na₂CO₃/BC > KOH/BC > BC > H₂SO₄/BC. The maximum adsorption capacities for Na₂CO₃/BC, KOH/BC, BC and H₂SO₄/BC were 24.79, 18.31, 17.38 and 9.17 mg g⁻¹, respectively. Removal of Cu²⁺ from Loakfoama, Bluff, and Briar Lake water samples confirmed that Na₂CO₃/BC was the superior modifying solution to KOH/BC, BC and H₂SO₄/BC. Removal percentages of Cu²⁺ by Na₂CO₃/BC were 99.99, 96.79 and 91.74%, respectively for Loakfoama, Bluff, and Briar Lake waters. H₂SO₄/BC exhibited the smallest percentage removal of 69.99, 61.54 and 58.91%, respectively for Bluff, Loakfuma and Briar Lake waters. Low Cu²⁺ removal by H₂SO₄/BC (surface area 326.7 m² g⁻¹) was attributed to the competition for sorption sites by H⁺ because of low solution pH (<3). These results demonstrated that Na₂CO₃/BC can be used as a low-cost adsorbent for Cu²⁺ removal from any waters that may be contaminated by the human activities listed prior.

75

Name: Black, Addison

Major: Civil Engineering

Faculty Advisor: Mary E. Dozier, Psychology

Funding: Shackouls Honors College Research Fellowship

How does being a musician impact sense of self?

This study will compare musicians to other musicians and against a control group of non-musicians across a spectrum of several personality and self-perception measures, including scales of anxiety, depression, self-efficacy, self-esteem, a Big Five personality assessment, and more to determine the trends within these two groups. The importance of this research holds great importance outside the psychology and music spheres and into more general education fields. By understanding the types of traits present in musicians and how they perceive themselves, this could lead to further studies to understand how expression through music can shape a person's personality and view of themselves. This could be especially helpful in impacting adolescents and children; if musicians are shown to have higher self-esteem and a more positive self-perception of themselves than non-musicians, than encouraging higher levels of music education during childhood could lead to happier and more confident teenagers and adults. In a similar vein, if musicians are shown to have higher levels of anxiety, depression, substance abuse, neuroticism, and lower self-esteem than non-musicians, than strategies that support and encourage music students into a more healthy development could potentially intervene and prevent some of these more damaging traits from forming.

155

Name: Blaise, Taylor

Major: Horticulture

Faculty Advisor: Tongyin Li, Plant and Soil Science

Co-Author(s): Jacob Arthur, Guihong Bi, and Logan Wood

Funding: College of Agriculture and Life Sciences URSP

High Tunnel Production of Strawberry (*Fragaria × ananassa*) Using Plastic and Biodegradable Mulches

High tunnels have been used as season extension tools for a number of horticultural crops, including strawberry (*Fragaria × ananassa*). In many areas in the United States, high tunnels are used to improve economic return by allowing growers to produce in the off-season. Five strawberry cultivars including four June-bearing cultivars ('Camarosa', 'Camino Real', 'Strawberry Festival', and 'Fronteras') and one day neutral ('San Andreas') were used in this study. Strawberries were transplanted into a high tunnel located at the R.R. Foil Plant Research Center at Mississippi State University in Fall 2021 and 2022 and evaluated for vegetative growth, fruit yield, and quality when grown on four types of mulches in a high tunnel. Strawberries were grown using three biodegradable mulches, including Organix A.G, WeedGuard Plus, and FilmOrganic, and one conventional polyethylene mulch as the control. Preliminary data showed that plant vegetative growth and yield components varied among cultivars and mulch types. For soluble solids content (°Brix) and Firmness (N),

there was significant interaction between cultivar and mulch type. The cultivar 'Strawberry Festival' produced the highest soluble solids content of 12.1 °Brix and 11.8 °Brix when grown with Organix A.G. and FilmOrganic respectively, compared with other treatment combinations. The cultivar 'Strawberry Festival' grown with the WeedGuard Plus mulch produced the firmest fruits of 2.74 N.

156

Name: Boccaleri, Quentin

Major: Forestry

Faculty Advisor: Adam Polinko, Forestry

Co-Author(s): Bruno Kanieski da Silva

Funding: College of Forest Resources Undergraduate Research Scholar's Program

A Thinning Response Formula for Southern Yellow Pine Plantations

Carbon-based management is an emerging objective of the forest industry, worldwide. In the world of Southern forestry, the primary challenge comes from incorporating management for carbon within the traditional management plan of a yellow southern pine plantation. Meanwhile, thinning can be considered one of the major silvicultural activities conducted in southern forestry. Additionally, thinning has a major impact on biomass produced by a stand throughout its lifetime. Understanding the impacts that thinning has on growth and yield, in relation to age, density, and site conditions, is vital for the management of carbon. The creation of a carbon-focused thinning response model and formula would allow for foresters and landowners to better understand these relationships and impacts. This project seeks to develop this model and formula. To achieve this, the following were conducted: 1) a literature review on the known impacts of thinning on stand yield and its relationship with carbon yield, 2) a meta-analysis and meta-regression, where data from different thinning regime trials was analyzed to understand the direct impacts of thinning on carbon yield, and 3) Analyze the tradeoffs of carbon management within in thinning-based management plan. We will present and discuss results and provide management recommendations.

76

Name: Bogle, Greyson

Major: Psychology

Faculty Advisor: Bennett W. Porter, Psychology

Investigating a method of verifying military of survey participants

Online surveys are a cost-effective method of conducting research on a variety of topics. However, utilizing online participants comes at the risk of recruiting outside the population of interest. Even worse, some participants may be intentionally dishonest about their background to participate in a survey to receive compensation. Currently, there is difficulty for researchers in verifying the military status of survey participants. As it stands, there is no reliable method for weeding out online participants with non-military backgrounds from active duty or veteran participants, who may be in the intended population of a study. The purpose of the present study was to evaluate if identifying a correct uniform presentation out of a lineup was a viable method of weeding out non-military participants. We had nearly 200 undergraduate students ($n = 188$) complete a series of questions testing their ability to correctly identify a soldier whose uniform was in line with regulation versus a soldier whose uniform was not in regulation. Of the included participants, eight reported military service, 44 reported an immediate family member in the military, 61 reported a second-degree relative in the military, and 75 reported not having a family member in the military. Participants were presented a lineup of images, each presenting the same soldier in one correct uniform presentation and three incorrect uniform presentations. Participants then attempted to identify the correct uniform presentation. An ANOVA was completed to compare the accuracy of the military participants versus non-military participants. Overall, there was a significant difference overall ($F(3,184) = 4.32, p = .006$), with the military participants scoring significantly more accurately than any group of non-military participants, including those with an immediate family member in the military ($b = 1.37, p < .001$). Overall, these results show that using an identification task of correct versus incorrect uniform presentation is a viable method of weeding out non-military participants from an online survey.

77

Name: Borel, Claire

Major: Fashion Design & Merchandising

Faculty Advisor: Caroline Kobia, School of Human Sciences

Funding: College of Agriculture and Life Sciences URSP

Greenwashing: Exploring Contributing Factors in Fashion Sustainability; A Case Study of Small Fashion Businesses in Mississippi

While many sustainability initiatives exist, the fashion industry is still grappling with the concept. Consumers are demanding more eco-friendly clothing and practices. Hence, retailers must adapt to maintain consumer loyalty. Most recently, some bigger retailers are under scrutiny due to "greenwashing," a practice where companies market a product as sustainable to deceptively appear greener to the

consumer (Compare Ethics, 2020). The U.S. government has enacted initiatives over the years to help protect consumers, but due to their limitations, there are other firms providing third-party certifications (Compare Ethics, 2020; Sierra, 2022). Most of these initiatives, however, are too large scale for Small-Medium Businesses (SMBs). SMBs face different challenges to adopting sustainability than larger businesses; therefore, SMBs require more distinctive initiatives and practices. Hence, the purpose of this study is to explore the practices and underlying needs and challenges facing fashion SMBs in rural Mississippi in implementing sustainability to avoid greenwashing. The specific objectives are 1) explore SMBs current sustainable practices, 2) explore challenges to embracing sustainability efforts by retailers, 3) explore the disconnect between government regulations and retailers' compliance, and 4) provide recommendations for retailers for a greener industry. The study is grounded on the Human-Centered Design (HCD) approach. HCD has three phases: Inspiration, Ideation, and Implementation (www.designkit.org, n.d.). In the Inspiration Phase, surveys will be conducted with retailers to understand their needs, challenges, and current sustainable practices. Using the retailers' feedback, the Ideation Phase is about visualizing, brainstorming, and discussing potential solutions. In the Implementation Phase, the researchers will provide recommendations based on the findings from the prior two phases and outside research from the literature review. This study is currently still in the Inspiration Phase to allow the successful collection of data to provide the most comprehensive recommendations possible.

78

Name: Bounds, Mary Charles

Major: Human Development & Family Science

Faculty Advisor: Alisha M. Hardman, School of Human Sciences

Funding: USDA NIFA AFRI ELI Research, Extension Experiential Learning for Undergraduates (REEU) Fellowships Program

Using evaluation data to meet the needs of parents and families of children with disabilities in Mississippi.

Many rural communities lack access to parent education, let alone quality resources for children and families. The Trauma-Informed Parenting and Professional Strategies (TIPPS) project is an ongoing initiative with MSU Extension and the Mississippi Department of Human Services to educate and equip parents to meet the developmental needs of their children. The TIPPS team developed and distributed free parenting toolkits to participants (caregivers). Each participant receives a series of three toolkits intended to promote optimal child development and strong family bonds. Each toolkit is packed with toys, books, and information about topics such as coping strategies, positive behavior supports, and self-care. TIPPS staff members contact families following each toolkit to provide technical assistance (e.g., answer questions) and collect evaluation data. While families loved the toolkits, in conversation with the TIPPS staff, several parents mentioned a need for resources tailored to children with disabilities, predominately those diagnosed with autism spectrum disorder (ASD). For instance, one caregiver said "...I would love an autism box with my kids and to help my niece who is nonverbal by giving her different resources." Another caregiver said "The kits are nice kits to have. [I'm a] Mom with [a] special needs [child] and keeps me encouraged and I am always looking up different information. I would love an autism box." This feedback inspired the research and development of an autism toolkit, sent upon request to families within the existing participant sample. These toolkits are currently being packed and sent to families across the state of Mississippi. This project reveals the importance of participatory research in empowering communities and creating meaningful change.

79

Name: Bowen, Kayla

Major: Fashion Design & Merchandising

Faculty Advisor: Juyoung Lee, School of Human Sciences

Co-Author(s): Tykiera James, Leah K. Preston, Jessica Taflinger, Hailey Hansen

Funding: College of Agriculture and Life Sciences URSP

Lifestyle effects GPA

Academic performance can vary amongst college students for multiple reasons. The following study explored the relationship between lifestyle choices (i.e., sleep, listening to music while studying, diet and exercise) and academic performance. The topic of how lifestyle behaviors impact study habits is important to investigate because students can use the information provided in these studies to analyze their own lifestyle habits and make any changes, they deem necessary to reap benefits regarding their education and future pursuits. The research team hypothesized that an increase in physical activity and healthier diets would be related to better academic performance. The researchers also hypothesized that listening to a preferred genre while studying would also be related to better academic performance. Lastly the researchers hypothesized that adequate sleep would be correlated with better academic performance. Participants completed an online survey that included measures of academic performance, sleep quantity and quality, physical activity, and diet.

80

Name: Brake, Lucy

Major: Educational Psychology

Faculty Advisor: Jianling Xie, Counseling, Educational Psychology, and Foundations

TikTok Addiction and Student Learning Outcomes: The Mediating Role of Self-Regulation

As the social media application TikTok has grown in popularity among college students, many have been interested in understanding how TikTok usage may impact learning outcomes. To explore this relationship, I developed a questionnaire regarding five factors: perceived TikTok addiction, actual time spent on TikTok, perceived effect on learning outcomes, actual learning outcomes, and TikTok self-regulatory habits. I distributed this survey to 118 college students (ages 18 to 47, $M = 21.52$, $SD = 3.115$; 112 female, 4 male, 2 non-binary) via Qualtrics. I found a statistically significant relationship between perceived TikTok addiction and perceived learning outcomes, with the relationship mediated by TikTok self-regulation. These findings implicate the high levels of TikTok usage in college students have a negative impact in their perception of learning outcomes. They also demonstrate the impact of self-regulation on this relationship. Knowing this, educators are better able to help students lessen the effects of their TikTok usage on their perceived learning outcomes.

157

Name: Brasher, Hannah

Major: Animal and Dairy Science

Faculty Advisor: Leyla Rios de Alvarez, Animal and Dairy Sciences

Funding: College of Agriculture and Life Sciences URSP

Preliminary Effect of Cottonseed as a Source of Gossypol on the Artificial Infection of *Haemonchus contortus*

Gossypol is a polyphenolic aldehyde found in cottonseed (*Gossypium hirsutum*). Cottonseed (C) is a readily available feedstuff commodity in the southeast of United States; therefore, it has potential for usage as an inexpensive source of fat and protein and is promising for animal producers in this region. Gossypol has been studied for its negative effect on the reproduction of males. However, in the present study, we hypothesized a possible anthelmintic effect of cottonseed, source of gossypol (polyphenolic compound) against *Haemonchus contortus*. For this purpose, 4-month-old Boer x Spanish cross does ($n=40$) were randomly assigned to 4 treatments ($n = 10$), based on the supplementation (0.5% body weight-BW in kg), C vs. pelleted feed (NC), and no parasite infection (NP) or artificial infection with 4,000 L3 of *H. contortus* (P). For 8 weeks FAMACHA©, BW, and eggs per gram of feces (EPG) using the McMaster technique were recorded from each animal. The experimental design used was a 2x2 factorial. Normality was tested using Wilk-Shapiro, followed by an ANOVA. Those variables not following a normal distribution were analyzed using Kruskal - Wallis nonparametric test. Weights were analyzed using the MIXED procedure of SAS 9.4. Goats fed with C had a similar BW than those fed with pellets, 29.14 and 29.80 kgs, respectively. Furthermore, the C fed animals had a higher EPG (1074.4 ± 473.4) compared to those eating pelleted feed (672.7 ± 297.07) ($P < 0.05$). Non-artificially infected animals presented minimum EPG (8.1 ± 8.9 and 3.7 ± 6.05 for NCNP and CNP, respectively) as part of a natural infection (Figure 1). FAMACHA© for both parasitized groups were similar, 2.77 and 2.84 for NCP and CP, respectively, but higher ($P < 0.05$) than the FAMACHA© of the non-infected animals of 2.29 and 2.41 for NCNP and CNP, respectively. From this study alone, the presence of cottonseed in the diet of female meat goats did not have a positive effect on reducing the parasite infection, contrary to what was expected.

158

Name: Breland, Austen

Major: Biomedical Engineering

Faculty Advisor: Steven H. Elder, Agricultural & Biological Engineering

Funding: Shackouls Honors College Research Fellowship

Analysis of Punicalagin's Effect on Cartilaginous Aggrecan Degradation via ADAMTS-5

Osteoarthritis (OA) is a chronic, degenerative disease that affects millions of Americans. This condition involves the gradual degradation of articular cartilage that covers the end of long bones in joints like the knee. OA is associated with pain, stiffness, swelling, and loss of range of motion in the affected joint. The most prevalent articular-injected treatment methods for OA, corticosteroids and hyaluronic acid, only temporarily reduce symptoms with no long-term benefits. This project worked to develop an effective, long-term treatment method for OA that actively prevents the degradation of cartilage. ADAMTS-5 is a principal destructive enzyme in the progression of OA and is the main enzyme involved in the breakdown of the cartilage extracellular matrix (ECM) via the extraction of aggrecan, the main proteoglycan in collagen. Punicalagin (PCG), which has been previously demonstrated to convey chondroprotection against collagenase breakdown, is part of a class of molecules called polyphenols that are widely being researched for their anti-inflammatory properties. In this experiment, porcine cartilage explants were exposed to a buffer solution containing ADAMTS-5 and compared to a separate group of explants that were exposed to the same buffer which also contained PCG. They were incubated at 37 °C under orbital shaking at 100 rpm. Explants from both groups were collected at specific time intervals. The mass of glycosaminoglycan (GAG) present in each group

after each specific period of exposure was measured to determine whether PCG inhibited aggrecan breakdown due to ADAMTS-5. Results indicated significant degradation resistance as indicated by higher GAG content in explants treated with PCG. This further demonstrates PCG's potential as a disease-modifying OA drug.

81

Name: Brinner, Jada

Major: Psychology

Faculty Advisor: Hilary DeShong, Psychology

Co-Author(s): Kren Kelley, Courtney Mason

The mediating role of emotion regulation strategies within childhood adversity and suicide risk.

Research suggests there is a strong relation between adverse childhood experiences and suicide risk (Perez et al., 2016; Thompson et al., 2019). There is evidence that emotion regulation strategies could be amplifying the relation between adverse childhood experience and suicidal behavior (McLafferty et al. 2019). However, research typically does not examine the various components of emotion dysregulation, such as negative self-perceptions and engaging in impulsive behaviors. The current study examined how childhood adversity is associated with various forms of emotion dysregulation and whether specific dimensions of emotion dysregulation mediate the relation between childhood adversity and suicide risk. Data was collected from undergraduate students (N = 918) as part of an online study. Participants completed the Adverse Childhood Experiences Questionnaire, the Difficulties in Emotion Regulation Scale, and the Suicide Behaviors Questionnaire – Revised as part of a large data collection procedure. A parallel mediation analysis was conducted in SPSS AMOS 28. Childhood adversity demonstrated significant direct effects on all six dimensions of emotion dysregulation. Additionally, childhood adversity had a significant direct effect on increased suicide risk and this relationship was partially mediated by emotion dysregulation. Specifically, limited access to emotion regulation strategies mediated the relation between childhood adversity and suicide risk, while the remaining dimensions of emotion dysregulation were not associated with suicide risk. The current study suggests that adverse childhood experiences contribute to heightened emotion regulation difficulties across each dimension of emotion dysregulation. Meanwhile, childhood adversity may contribute to the idea that there are limited strategies available to successfully cope with distressing emotional experiences that subsequently increases risk for suicide. Future research should continue to expand on this line of research by investigating specific emotion regulation strategies as potential protective factors for suicide risk.

159

Name: Broadaway, Sarah

Major: Biochemistry

Faculty Advisor: Russell Carr, Comparative Biomedical Sciences

Co-Author(s): Kylee J. Burroughs, Angela K. Ross, Caera A. Taylor, Katelyn N. Sette, Parker Threat, Shirley X. Guo-Ross, and Kendall N. McKinnon

Funding: National Institute of Health - R15

Decision-Making In Adolescent Rats Exposed Repeatedly To Chlorpyrifos As Juveniles

Chlorpyrifos (CPF) is an organophosphorus insecticide that exerts toxicity through the inhibition of acetylcholinesterase in both insects and non-target species following higher levels of exposure. However, following exposure to levels that do not inhibit acetylcholinesterase, CPF will target the enzyme fatty acid amide hydrolase (FAAH) which is responsible for the degradation of the endocannabinoid anandamide. Any alteration of the endocannabinoid system in the developing brain could disrupt normal development leading to altered function. In fact, exposure of children to low levels of CPF has been associated with persistent behavioral problems including attention deficit hyperactivity disorder (ADHD) and decreased cognitive abilities. However, these types of effects have not been recapitulated in clinical animal models. A rendition of the Iowa Gambling Test (IGT), geared towards rodents, has been used to quantify risk-taking behaviors such as those associated with ADHD. The objective of this study was to determine if risk-taking behavior in the rat IGT is altered by repeated exposure to CPF. From 10-16 days of age, male and female rat pups were orally administered daily either corn oil, CPF (0.25, 0.5, or 0.75 mg/kg), or 0.02 mg/kg PF-04457845 (PF), a specific inhibitor of FAAH. On day 32, rats performed 12 trials per day for 10 days. The maze consisted of 2 empty arms and 2 arms containing either food or quinine-treated food. The rats' decisions were scored based on food/quinine arm selections and the subsequent decisions. Considering overall performance, the male rats exposed to all dosages of CPF and PF performed better than controls. However, this improvement was not observed in females. The basis for this improvement was that upon encountering a quinine-treated food arm, treated males had a reduced rate of returning to the same arm thereby increasing the chance of a correct selection.

45

Name: Buckholdt, Juliet

Major: Art

Faculty Advisor: Jenna Altomonte, Art

Picket Fences: How Alphabets Influence Design and Identity

It is well documented that language significantly impacts the way we interact with the world, affecting how we perceive color and even time. This begs the question, if we are so influenced by the set of words we work with, how influenced are we by the alphabets and letterforms that make up those words? While art history is often focused on stylistic movements and their chronology, there is great potential in a script-based analysis of the same bodies of work. This paper looks specifically at the English and Russian alphabets, exploring the theory that differences in Latin and Cyrillic typographical treatment can be traced back to inherent differences between Latin and Cyrillic letterforms, and furthermore, that native alphabets have a subconscious influence on designers' instincts and preferences. A variety of comparative experiments, such as Ukrainian typographer Yevgen Sadko's "averaged letter" explorations, are used to establish observed qualities and motifs of the two alphabets. These elements then provide context for an in-depth analysis of Russian Constructivism and German Bauhaus design, illustrating the ways in which the impact of letterforms can be found at the heart of nearly every major developmental difference between two movements which otherwise remained consistently visually connected. This research presents a perspective from which we can be mindful about linguistic identities and typographical instincts, ask further questions about how far that influence extends, and start to be mindful of how those influences are retained as design progresses beyond the early-mid 20th century.

160

Name: Burdine, Olivia

Major: Natural Resource & Environmental Conservation

Faculty Advisor: Esteban Galeano, Forestry

Co-Author(s): Austin Himes

Funding: Global Development Seed Grant

Controlled Crossing of Eastern Cottonwood: Production of Trees for the Future

Eastern cottonwood (*Populus deltoides*) exhibits significant advantages compared to other trees, such as ecological assets, fast growth, high amounts of biomass, and low-cost biofuel production. Our goal is to cross the genetics of trees cultivated and selected as superior trees for the last 30 years so that we may continue the improvement of this species for the benefit of the companies, science, and the environment. The controlled crosses of the Eastern cottonwood began with the selection of superior male and female genotypes in 'elite forests' at Pontotoc, Mississippi. Then, those branches were bundled together and stored in plastic bags. After the branches were brought to the MSU forestry greenhouse, they were placed in the freezer. The female branches were prepared before the male so that the females would have time to root before the males produce pollen. After three weeks, the female branches were trimmed at the base by one inch, dipped in a rooting hormone, and immediately placed in pots with soil. Then, all pots were placed in the freezer in a Styrofoam box being warmed with a heat mat at seventy degrees Fahrenheit. While the females were producing roots, the males were taken from the freezer, trimmed off by one inch at the base, placed in a bucket of water, and separated into separate rooms. After one week, pollen was collected into vials and stored in the refrigerator. When the females produced flowers, they were placed in the greenhouse, pollinated, covered with pollination bags, and maintained as they produced seeds. In the upcoming weeks, these seeds will be collected with a vacuum, sown, germinated, grown, and planted. Finally, we will evaluate how the new 'elite' trees—Trees for the Future—have improved in biomass and biofuel production. Therefore, we have a huge opportunity with this study to continue developing better seedlings of this species and foster biofuel production.

6

Name: Busby, Nicole

Major: Biological Sciences

Faculty Advisor: Todd E. Mlsna, Chemistry

Co-Author(s): Prashan M. Rodrigo, Hannah C. Hyland

Funding: Creekside Environmental Products

Application of MgO-SiO₂ Modified Rice Husk Biochar for Cu²⁺ Removal from Wastewater

This project focuses on removing toxic levels of Cu(II) from wastewater using MgO-SiO₂- modified rice husk biochar (MgO-SiO₂/RHBC). The major waste product, rice husk, contains a high ash content of amorphous silica. NaOH was used to extract the silica, and then MgCl₂ was implemented to redeposit it onto the biochar surface. This modified product was then pyrolyzed at 400°C for one hour, forming fused MgO-SiO₂ on the RHBC. Batch mode was then used to investigate the effects of solution pH, contact time, initial metal ion concentration, biochar dose, and the impact of competitive ions on adsorption capacities. Wastewater with high ionic strength was

simulated using a 0.01 M NaNO₃ solution matrix. The solution with the highest removal capacity was presented at pH 5 and was then chosen for additional experiments. Correspondingly, sorption equilibrium was obtained after 5, 15, and 120 minutes for 0.25, 2.5, and 25 mg/L initial Cu(II) concentrations, respectively. The batch sorption kinetics followed pseudo-second-order kinetics and had a Langmuir capacity of 38.0 mg/g at 25°C. A dose experiment with biochar was executed with a 100 mg/L initial Cu(II) solution with 1,2,3,4 and 5 g/L doses with removal percentages of 30.6±3.7, 45.8±2.3, 58.8±3.8, 76.4±1.8, and 81.4±2.8%. A breakthrough study involving a continuous-flow fixed-bed column was performed using a 2.5 mg/L initial Cu(II) concentration at pH 5. The MgO-SiO₂/RHBC and RHBC were characterized by scanning electron microscopy (SEM), transmission electron microscopy (TEM), and x-ray diffraction patterns (XRD). Lastly, X-ray photoelectron spectroscopy (XPS) was used to interpret the Cu(II) sorption mechanism on RHBC and MgO-SiO₂/RHBC.

161

Name: Callender, Emily

Major: Animal and Dairy Science

Faculty Advisor: Zully Contreas-Correa, Animal and Dairy Sciences

Co-Author(s): Nicolas Marchant, Lindsey Dearborn, Leyla Rios de Alvarez, Caleb Lemley, Micheal Pesato

Funding: 2022 MAFES Strategic Research Initiative

Preliminary Effect of Cottonseed as a Source of Gossypol on Hepatic Portal Blood Flow as an Indicator of Metabolism in Meat Does Artificially Infected with *Haemonchus contortus*

Cottonseed diets provide animals with high levels of protein and energy to support growth, while it could have potential anthelmintic effects that are beneficial to small ruminant operations. The objective of this experiment was to determine the effect of a cottonseed diet and parasite load on the hepatic portal blood flow which is an indicator of hepatic clearance rates and metabolism. Forty Boer x Spanish cross does were assigned to 1 of 4 treatments (n = 10 per treatment group) in a 2x2 factorial design consisting of a group that received commercial pellets with no parasite infection (CON) or commercial pellets plus *Haemonchus contortus* infection (CONP) and cottonseed supplementation with no parasite infection (CS) or cottonseed supplementation plus artificial infection with *Haemonchus contortus* (CSP). On week 8 post-treatment, hepatic hemodynamics measurements were collected via Doppler ultrasonography on the right side of the animal at the 10th intercostal space. Mean velocity, diameter and blood flow from the hepatic portal vein and does' body weight were analyzed with a One-way ANOVA using the MIXED procedure of SAS with diet and parasite load as the main effects and their interaction. A diet by parasite interaction (P = 0.026) was observed for the mean velocity of the hepatic portal vein, which was decreased in CSP versus CS treatments. A diet by parasite interaction (P = 0.012) was observed for the diameter of the hepatic portal vein, which was increased in the CSP treatment versus all other groups. However, absolute hepatic portal blood flow and body weight was not different (P > 0.05) amongst treatments. In conclusion, cottonseed interacted with parasites to decrease mean velocity and increase the diameter of the portal vein. This change in hepatic hemodynamics could have implications for mediating metabolism and clearance.

162

Name: Carter, Sydni

Major: Kinesiology

Faculty Advisor: Stamatis Agiovlasis, Kinesiology

Co-Author(s): Brantley K. Ballenger, Grant Norman

Funding: ORED Undergraduate Research Program, I'm an Athlete Foundation

Sedentary Behavior in Adults with and Without Down Syndrome

BACKGROUND: Low physical activity levels and high sedentary behavior have been observed among adults with Down syndrome (DS). Further investigation of sedentary behavior can provide insight into the behavior patterns of adults with DS. The purpose of this study was to compare sedentary behavior levels and patterns between people with and without DS matched for age, race, and sex. METHODS: Fifteen adults with DS (age 41±12 yrs.; 7 men) and 15 adults without DS (non-DS; age 37±11 yrs.; 7 men) wore a triaxial accelerometer (wGT3X-BT, Actigraph) on the non-dominant hip to measure sedentary behavior levels. Specific sedentary vector magnitude cut points were used for adults with DS (<236 counts/min) and non-DS (<200 counts/min). Sedentary bout analysis was performed based on ≥1 min, ≥10 min, ≥30 min, and ≥60 min bout lengths. Independent samples t-tests were performed to determine differences between groups for sedentary behavior variables. RESULTS: There were no differences between groups for wear days (DS: 6±1 days, non-DS: 7±1 days, p=.231) or wear time (DS: 5354±1329 min, non-DS: 5577±819 min, p=.292). Adults with DS had significantly fewer sedentary bouts lasting 10 min (DS: 66±32 bouts, non-DS: 89±26 bouts, p=.023), and 30 min (DS: 11±7 bouts, non-DS: 19±13 bouts, p=.019), but there was no difference between groups for bouts lasting 1 min (DS: 562±137 bouts, non-DS: 499±152 bouts, p=.121) and 60 min (DS: 2±2 bouts, non-DS: 5±6 bouts, p=.056). Adults with DS had significantly less average sedentary bout length for bouts lasting 1 min (DS: 5±1 min, non-DS: 8±5 min, p=.023) and 60 min (DS: 40±40 min, non-DS: 65±36 min, p=.043), but bouts lasting 10 min (DS: 21±3 min, non-DS: 23±7 min, p=.073) and 30 min (DS: 47±7 min, non-DS: 48±9 min, p=.301) did not differ. Even when the number of bouts between groups were not different (≥1 min and ≥60 min), adults with DS spent less average time in the bout duration. Also, adults with

DS had similar average bout duration while performing fewer overall bouts (≥ 10 min and ≥ 30 min). CONCLUSION: Adults with DS performed shorter and fewer bouts of sedentary behavior than adults without DS. Therefore, adults with DS may break up sedentary bouts at a higher rate than non-DS.

54

Name: Castañeda, Elisa

Major: Architecture

Faculty Advisor: Silvina Lopez Barrera, School of Architecture

Medellín and Its Social Urbanism Practices

Medellín is the second largest city in Colombia and is a major economic contributor to the country with a past deep rooted in political instability. When it was at the precipice of political turmoil and violence between 1984 and 1999, activists turned to investing in accessible public infrastructure in an attempt to address its social inequities. This led to the creation of Proyectos Urbanos Integrales (PUI) in the 1990s, initiatives that spurred a unique relationship between architecture and politics and has since been associated with the improved quality of life for inhabitants of Medellín. The long-term impact of these programs influenced the subsequent development of 'Social Urbanism' in Medellín, integrating social projects into the poorest districts of Medellín. This research analyzes how these practices can be a model for the future, as density in metropolitan areas is projected to increase, and informal settlements are to be the rule rather than the exception. It seeks to investigate what lessons can be learned from the PUI's methodology and approach from policy making to the implementation of architectural and urban projects. Furthermore, this research inquires about policy shortcomings, such as the increasing impact of climate change in these vulnerable communities, and what steps are being taken to incorporate sustainable practices to increase resiliency within Medellín's comunas. Research methods include case studies, site visits, on-site interviews, architectural analysis, and contextual research. Findings suggest over the span of 20+ years the program's focus has been mostly on addressing the susceptibility to armed conflict and urban violence, and concerns on environmental issues such as ecology and sustainability in the wake of increasing climate change risks have gotten less consideration. This research queries how local knowledge and government involvement can cooperate in finding solutions to environmental, social, and accessibility issues in the ever growing city of Medellín.

7

Name: Chamberlain, Kari

Major: Chemistry

Faculty Advisor: Dennis W. Smith, Chemistry

Co-Author(s): Gustavo Munoz

Semi-Fluorinated Aryl Ether Polymers via Friedel-Crafts Polymerization of Hexafluoroacetone Hydrate and Activated Arenes.

Friedel-Crafts polymerizations of arenes and heteroarenes are often used to produce polymeric materials with great versatility in scope and applicability. The insertion of semi-fluorinated moieties such as 1,1,1,3,3,3-hexafluoroisopropylidene (6F) into the polymer backbone imparts upon the materials a lower surface energy, hydrophobicity, and low dielectric constant. The 6F group offers valuable optical transparency in addition to increasing melt and solution processability. For this reason, we have recently developed a practical and direct synthesis of semi-fluorinated polymers by Friedel-Crafts reactions of hexafluoroacetone trihydrate (HFAH) with a variety of activated and non-activated aromatic monomers. This versatile, straightforward, and low-cost method allows the synthesis of polyaryl ethers and polyphenylenes with 6F linkages in their main chain. The new semi-fluorinated polymers were characterized by spectroscopy, GPC, TGA, and DSC. Results showed a successful polymerization with low branching depending on the reaction conditions, thermal stability until 500 °C under nitrogen, a glass transition (T_g) ranging from 157-250 °C, and molecular weights between 15-60 kDa. Finally, as its possible application, the optical and dielectric properties of these materials were studied.

163

Name: Chamberlain, Maggie

Major: Kinesiology

Faculty Advisor: Stamatis Agiovlasis, Kinesiology

Co-Author(s): Brantley K. Ballenger, Morgan Bailey

Funding: NIH Grant R15HD098660

Accelerometer Cut Points For Adults With Down Syndrome: Mets Vs. Oxygen Uptake Reserve

BACKGROUND: Accelerometer cut-points based on 3 and 6 Metabolic Equivalents (METs) for moderate and vigorous physical activity (PA) may not be appropriate for adults with Down syndrome (DS). PA intensity may be better reflected in the oxygen uptake reserve (%VO₂R) which can account for impairments to aerobic fitness. This study examined if accelerometer cut points for moderate and vigorous PA differ between METs and %VO₂R in adults with DS. METHODS: Twenty-three adults with DS (age 34±8 years; 11 men)

performed 18 tasks of varying intensity each lasting 6 min. Aerobic fitness was estimated with a submaximal treadmill test. The rate of oxygen uptake during the treadmill test and the 18 tasks was measured with breath-by-breath portable calorimetry. PA intensity during the tasks was expressed as METs (moderate: 3.0–5.99 METs; vigorous ≥ 6 METs) and %VO₂R (moderate: 40.0–59.9%; vigorous: $\geq 60\%$). PA was measured with a triaxial accelerometer (wGT3X-BT, Actigraph) on the non-dominant hip, and the Vector Magnitude (VM) was used in analysis. Receiver Operating Characteristic (ROC) curves were used to identify VM cut points for moderate and vigorous PA using METs and %VO₂R. RESULTS: Area under the ROC curve was high for all models; for METs: (a) moderate (0.89; 95%CI:0.85–0.92) and (b) vigorous (0.91; 95%CI:0.86–0.96); for %VO₂R: (a) moderate (0.88; 95%CI:0.84–0.91) and (b) vigorous (0.86; 95%CI:0.82–0.90). The optimal VM cut points based on METs were: (a) moderate ≥ 2863 counts-min⁻¹ (sensitivity 0.87; specificity 0.77; Y-index 0.64); and (b) vigorous ≥ 3698 counts-min⁻¹ (sensitivity 1.00; specificity 0.74; Y-index 0.74). VM cut points based on %VO₂R were: (a) moderate ≥ 2056 counts-min⁻¹ (sensitivity 0.99; specificity 0.68; Y-index 0.67); and (b) vigorous ≥ 3698 counts-min⁻¹ (sensitivity 0.77; specificity 0.80; Y-index 0.57). CONCLUSION: Utilizing cut-points based on %VO₂R may more accurately express levels of moderate PA in adults with DS.

82

Name: Chapman, Laura

Major: Psychology

Faculty Advisor: Danielle Nadorff, Psychology

Co-Author(s): K'lee Pittman and Alexandria Davis

Grandparenting in the Digital Age: Loneliness and Computer Usage in Children Raised by Grandparents

The United States Census Bureau estimates there were 5,793,873 children living in “grandfamilies” in 2021. Children reside with a grandparent caregiver when a parent is unwilling or unable to care for their child, which often overlaps with traumatic experiences. These children are also at risk of developing disrupted attachment due to the separation. Increased exposure to traumatic events and disrupted attachment are linked with emotional issues in children, including feelings of loneliness. Increased traumatic experiences in childhood were linked with problematic internet use in emerging adulthood to cope with feelings of loneliness. Data from the second wave in the national Health Behavior in School-aged Children (HBSC) study was used to explore this hypothesis ($N= 12638$; 1.9% grandchildren; $Age = 12.95$). Moderation analyses indicated the overall model was significant and accounted for 9% of the variance ($R^2 = .09$, $p < .01$). The moderation of household type was not significant. The relation between loneliness and number of hours spent on the computer was significant ($b = 5.1$, $t(237) = 2.38$, $p < .01$). The results show that while there is a significant relation between the children’s feelings of loneliness and the number of hours they spend on the computer daily, there was no significant difference between types of family units. Children with feelings of loneliness may use internet as a coping mechanism broadly, regardless of their family system. Targeted interventions to provide safe internet usage for children experiencing loneliness should be explored. Grandparents may benefit from psychoeducation on problematic internet usage for their grandchildren.

164

Name: Chen, Meng Xiang

Major: Software Engineering

Faculty Advisor: Haifeng Wang, Industrial and Systems Engineering

Co-Author(s): Abdur Rahman, Yuzhen Lu

Developing a Prototype of Cost-Effective Artificial Intelligence System for Real-time Cotton Weed Detection

Weeds pose a substantial threat to the final yield of cotton productivity. To eradicate weeds with site- and species-specific herbicides, it is essential to precisely classify and localize the weeds. Deep learning machine vision technology has emerged as an efficient solution to address this issue. However, the proper implementation of machine vision technology requires multiple phases, including data collection, model development, training, and deployment. While research regarding the first three phases has been extensive, more investigation into the fourth step—transferring the trained model to a device with resource constraints such as Single Board Computer (SBC)—is warranted. In this study, we report the implementation details of a pre-trained YOLOv5 model on an NVIDIA Jetson Nano SBC for cotton weed detection. The implemented weed detector can detect the cotton weeds in real-time with a certain confidence score. This implementation (https://github.com/mcPython04/weed_detection) will serve as a resource for the development of prototypes and, eventually, industrial-scale field-deployable equipment.

165

Name: Chen, Zijie

Major: Computer Science

Faculty Advisor: Sungkwang Mun, Center for Advanced Vehicular Systems

Predicting the Antibacterial Effectiveness of Nanotextured Surfaces Using Transfer-Learning

The goal of this study is to predict the effectiveness of various antibacterial surfaces using the Machine Learning (ML) method.

Antibacterial surfaces are the nanotextures that prevent bacterial adhesion and thus suppress biofilm formation. In order to build correlations between many types of nanotextures and various bacterial strains, and to develop an optimized design framework, we employed ML, which has grown rapidly in recent years and has been affecting many engineering and scientific fields in the context of data analysis, such as classification and regression. Firstly, through the method of transfer learning, we used a pre-trained convolution-based neural network (CNN), such as ResNet18 composed of 152 various computational layers trained over 1 million images with 1000 categories, to learn the new task by fine-tuning the parameters (weights and biases) of the final fully connected layer of the network, as transfer learning can transfer quickly learned features to the new dataset. For the training database, we used two different antibacterial effectiveness levels of 5% and 65% with a size of 256x256 cropped scanning electron microscope (SEM) images taken in 10,000 and 20,000 magnifications. We used Pytorch software for transfer learning to train over new datasets on GPU. After evaluating various combinations, we found that with a total of 100 images that 80 for training and 20 for validation are sufficient to retrain the pre-trained CNN model. The average computational time for training 100 images is 34 seconds with an average training accuracy of 90.12%. Finally, we ran ten more effectiveness levels with different nanotextures, which resulted in higher accuracy in the CNN network.

8

Name: Cho, Minjae

Major: Mechanical Engineering

Faculty Advisor: Sungkwang Mun, Center for Advanced Vehicular Systems

Funding: Bagley College of Engineering Undergraduate Research Stipend

Development of Parameter Dependent conditional Generative Adversarial Network (PDcGAN) Model for Multi-Phase Flow Prediction

Development of Parameter Dependent conditional Generative Adversarial Network (PDcGAN) Model for Multi-Phase Flow Prediction Machine learning and artificial intelligence (ML/AI) techniques have had a significant impact on various scientific and engineering fields by uncovering new insights from data or predicting previously untested properties. Deep learning, particularly in the form of artificial neural networks, has been instrumental in the success of ML/AI. Our research focuses on developing a deep learning framework using a conditional Generative Adversarial Network (cGAN) to predict the complex spray and air-fuel mixing in gasoline direct-injection (GDI) engines. This has been a major challenge due to the complicated two-phase flow dynamics involved. Our Parameter Dependent cGAN (PDcGAN) predicts the fuel's 3D shape based solely on its sprayed condition and fuel property. Our training dataset consists of nine different fuels sprayed through multi-hole injectors 100 times each and projected into a combustion chamber. The projected images are acquired from three different camera angles and later used for 3D reconstruction as post-processing. These images are converted to pixel intensity data based on physically quantitative projected liquid volume (PLV) and separated into a training and validation set before training with the PDcGAN algorithm implemented in MATLAB. After extensive training on a GPU, the model can predict the morphology of fuels not included in the training data. Our research has identified optimal parameters and network architecture that yield an average test set error of around 10-15%. While this error rate may be considered high for practical use, it is important to note that engineers typically spend three hours using CFD (computational fluid dynamics) to predict the shape of a single fuel, requiring significant computational resources. In contrast, our trained algorithm, PDcGAN, provides results in seconds, making it a more efficient solution for engineers without access to supercomputing resources. We anticipate that the model's accuracy will continue to improve as we expand the dataset to include a wider range of fuels.

166

Name: Coleman, Curtis

Major: Wildlife, Fisheries & Aquaculture

Faculty Advisor: Garrett Street, Wildlife, Fisheries, and Aquaculture

Co-Author(s): Jane Dentinger, Bronson Strickland

Adrift in time: Correcting time drift in animal-borne accelerometer and magnetometer dataloggers using animal behavior

Throughout the United States, the invasive wild pig (*Sus scrofa*) costs billions of dollars in damage and control efforts. In recent years, accelerometer and magnetometer dataloggers (AM loggers) have been used to study the behavior of animals offering opportunities for enhanced wildlife management. In this project, we used data from AM loggers and video recordings of captive wild pigs at Mississippi State University in 2016. These dataloggers measure fine scale three-dimensional movements of animals and produce unique signals for each behavior. Generally, to determine which signal patterns correspond to which behavior, we align AM signals to the recorded behavioral observations by their shared timestamps. However, the dataloggers accumulated "time drift", creating a discrepancy between when a behavior was observed and where that behavior occurred in the recorded time-series of movement signals. Thus, we looked for distinctive patterns in the data caused by abrupt changes from the flat signals characteristic of resting to the highly dynamic signals characteristic of walking to determine the time drift between time of the observed behavior and appropriate AM signal. We calculated offsets for each day of data, fit linear models to the time drift of each pig, and applied these models to the data to correct for behaviors we did not observe. This resulted in alignment between the datalogger signals and video-recording behavior for most of the behavioral

observations. This method can be used to correct time drift in AM signal data enhancing predictive performance and increasing the effectiveness of AM loggers for future studies of animal behavior.

55

Name: Coleman, Oliver

Major: English

Faculty Advisor: Lourdes Cardozo-Gaibisso, English

Funding: ORED Undergraduate Research Program

Advancing Equity through the Scientific & Multilingual Inquiry Learning in Engineering (SMILE) Pedagogical Model: Insights from Mississippi

Currently, there is a rapidly increasing need for Multilingual Learner (ML) support in the Southeastern United States. A particular need is seen in STEM teaching. The Scientific & Multilingual Inquiry in Engineering (SMILE) model provides a systematic framework to support Mississippi high-school physics and physical science teachers and their MLs. This model consists of four key principles. The first principle is Language Development for STEM Meaning Making which focuses on teaching the Language of Science (LoS) to enable students to engage in scientific discussions and with scientific texts. The second principle is Culturally Sustaining Praxis which centers around recognizing the subjective history and construction of science knowledge and how to incorporate cultural inclusivity for all students. The third principle is Coding and simulation-based curriculum backed by experimental demonstrations which emphasizes the importance of integrating conceptual visualizations to help students connect learning to the real world and develop individual interest. The fourth principle is School-career connections and workforce development which incorporates vital certification and professional networking opportunities to support students in workforce development. The design of this study consists of identifying student populations in need, surveying teacher needs and interests and then applying SMILE and observing its effects to better refine it. A preliminary survey distributed to Mississippian high school science teachers revealed that, although the majority taught MLs, only 8% had an English to Speakers of Other Languages (ESOL) endorsement. Additionally, all the teachers were willing to incorporate computational tools and instruction into the classroom if provided the appropriate resources and training. Further research focuses on specifying the knowledge teachers hold on SMILE concepts as well as their understanding of the connections between language and STEM content and how this can be used to improve ML learning.

167

Name: Corzine, Rosalynn

Major: Biological Sciences

Faculty Advisor: Justin A. Thornton, Biological Sciences

Co-Author(s): Yuri Laguna, Jordan Coggins, Keun Seok Seo

Identifying Mechanisms of Antibiotic Uptake in *S. pneumoniae*: The role of metabolic transporters

Streptococcus pneumoniae (pneumococcus) is a gram-positive bacterium that colonizes the human nasopharynx. It is a leading cause of bacterial pneumonia and otitis media, as well as a common cause of sepsis, and meningitis. Methods for preventing these infections include the pneumococcal conjugate vaccine (PCV), and common prescription antibiotics. Over the years, pneumococcus has evolved resistance to numerous antibiotics. While antibiotic resistance is a well-studied dilemma, little information is known of how pneumococcus uptakes certain antibiotics. Because most antibiotics cannot diffuse freely across the bacterial cell wall, we hypothesize that metabolite transport proteins participate in the uptake of certain classes of antibiotics. Previous research in our lab used a TnSeq library of *S. pneumoniae* to identify genes potentially involved in antibiotic susceptibility. A gene encoding a pullulanase enzyme (SpuA) and a gene from the AmiA-E operon were identified to be involved in the susceptibility of pneumococcus to azithromycin (AZM) and fosfomycin (FOS), respectively. To evaluate the contribution of these genes to antibiotic susceptibility, isogenic knockout mutants were constructed. Wild-type and isogenic mutants were exposed to different concentrations of antibiotics (FOS or AZM) and subsequent growth curves assessed antibiotic susceptibility. Because SpuA is involved in carbohydrate metabolism using MalXCD transport, MalX KO mutants were constructed. However, SpuA and MalX KO strains failed to result in resistance to AZM. Therefore, we are currently constructing MalCD KO mutants. The Ami-E KO as well as an Ami A-E KO showed nearly complete fosfomycin resistance, indicating this pathway is likely involved in the uptake of FOS. Future plans include creating a luciferase reporter strain to screen small molecules for the ability to induce the Ami A-E operon, which we hypothesize would increase antibiotic uptake. Such small molecules could potentiate the effects of antibiotics and possibly reverse resistance.

168

Name: Cowan, Elizabeth

Major: Biochemistry

Faculty Advisor: Priyadarshini Chakrabarti Basu, Biochemistry, Molecular Biology, Entomology, and Plant Pathology

The Effects of Environmental PFAS on Honey Bee Health and Human Health Implications of Consuming PFAS-Contaminated Honey Products

Per- and polyfluoroalkyl substances (PFAS) are a group of anthropogenic aliphatic hydrocarbons in which most-to-all hydrogen atoms have been replaced by fluorine, making them valuable in industry as highly effective surfactants. Their grease- and water-repellent properties also cause PFAS compounds to be extremely environmentally persistent, earning them the nickname of "The Forever Chemicals." The bioaccumulative properties of PFAS compounds have been linked to various health and environmental problems. Honey bees play an important ecological and economical role as pollinators. Additional hive products such as honey and wax also contribute to the global economy, with honey being a preferred sweetener for many. In light of the global pollinator decline, studies on the effects of such a ubiquitous pollutant as PFAS on honey bees and the accumulation of PFAS in honey are crucial. Human consumption of PFAS-contaminated honey products concerns human health, particularly that of children. This review explores the toxic impacts of PFAS compounds on honey bees and other pollinators, the prevalence of PFAS contamination in honey, and the potential PFAS exposure routes for pollinators, including honey bees.

83

Name: Craddock, Garry

Major: Agricultural Education, Leadership, and Communications

Faculty Advisor: Jessica Benson, School of Human Sciences

Need to Know: What Students Want Faculty to Know About Creating Enjoyable Groupwork Experiences

Students ultimately believe groupwork is a beneficial instructional technique if utilized correctly. The purpose of this study was to explore students' preferences when working in groups and provide insight to practitioners on students' wants and needs when it comes to groupwork. Eighteen undergraduate students enrolled in an agriculture and life sciences team leadership course participated in the study. Students prefer self-selected methods of grouping (n=8) over randomly assigned methods of grouping (n=7); whether the self-selection method is criterion-based or not. Students who selected either self-selection grouping method prefer this method because it allows them to select people that: they already know and trust, they naturally gravitate toward, have similar interests, goals, and work ethic. Complementary personalities characteristics, interest in the groupwork, ability to work in a group, open-mindedness, and balanced strengths and weaknesses (technical and non-technical) among group members are not only the criteria students are using to self-select, but also the criteria they want faculty to consider when assigning groups. Seventeen of the 18 student participants expressed their primary expectation for their peers is for them to pull their weight by actively participating and contributing to the groupwork. Effective communication, time management, and respect are also common expectations for group members. Students approach groupwork differently, depending on their past experiences; this study revealed that most participants prefer a consistent collaborative approach to groupwork (n=12) over the divide and conquer or one individual to do the bulk of the work approaches. Additionally, students prefer to meet with their group face-to-face(n=15) but ultimately want the groupwork to get completed. Furthermore, eight students expressed a direct desire to serve a leadership role within their group. Practitioners should utilize students' perspectives and consider their wants and needs towards groupwork in order to create conducive environments where groupwork is enjoyable, effective, and impactful.

84

Name: Crawford, Caroline

Major: Wildlife, Fisheries & Aquaculture

Faculty Advisor: Leslie Burger, Wildlife, Fisheries, and Aquaculture

Funding: College of Forest Resources Undergraduate Research Scholars Program

The impact of COVID-19 on undergraduate students' professional experience

Careers in wildlife, fisheries, and aquaculture sciences are typically hands-on, and professional experience during the undergraduate years is critical for students to successfully acquire jobs after graduation. We explored how the COVID-19 pandemic affected undergraduate students' ability to obtain the summer professional experience necessary for future employment. Five years (2018-2022) of survey data collected from Mississippi State University students majoring in Wildlife, Fisheries, and Aquaculture (WFA) were analyzed to understand how COVID-19 changed students' summer plans. In 2020 and 2021, students reported that COVID-19 had impacted their ability to gain professional experience during the summer. Approximately 17% of students in 2020 and 9% of students in 2021 reported that they could not obtain summer professional experience due to limited opportunities. Students also reported that they were unable to obtain summer professional experience due to COVID-19 related family health concerns or financial difficulties. In 2022, 94% of upperclassmen who reported obtaining summer professional experience did not experience effects from COVID-19. While these results are promising, there are still lingering effects of the COVID-19 pandemic on undergraduate students. The lack of summer professional experience may need to be compensated for in undergraduate curriculum in the next few years for students to be just as prepared for a career or graduate school as previous classes of graduates. Further, it is important for hiring managers to recognize that the upcoming classes of undergraduates may not have the same amount of professional experience as previous groups of students.

9

Name: Crawley, Dalton

Major: Computer Engineering

Faculty Advisor: Victor Souza Martins, Agricultural and Biological Engineering

Deep learning for building detection using aerial images in Starkville/MS

Urbanization is essential to the rapid growth of communities across the world and has made its presence felt throughout the different eras of human development. Empires have been birthed, Wars have been waged, and Extraterrestrial travel was accomplished all utilizing the profits of urbanization. However, societies have had varying results as it relates to the speed at which they modernize with some communities constructing skyscrapers and others still hunting and gathering. Starkville, Mississippi has been growing since Mississippi State's founding and has turned into a town that stretches for miles, so what has Starkville accomplished in areas of urbanization that have allowed the community to prosper, and can we measure just how impactful Starkville's progression has been within the last 20 years? To evaluate the modernization of Starkville I have decided to measure the increase in the quantity and size of the buildings in the town. This will be accomplished by using a machine learning algorithm from U-NET that will process satellite images of Starkville now and 20 years ago using the Aeronautical Reconnaissance Coverage Geographic Information System satellite database and will return the images with all buildings marked automatically. Not only will we see the difference in the number of buildings; but we will also see the evolution of the terrain in the surrounding area as a result of urbanization. The urbanization of Starkville has gone smoothly, so is there a way to formulate a long-term building strategy that can help other smaller communities develop with results like that of Starkville? Having other communities around the world use and improve upon guidelines created here can reduce excess land usage and help communities lay a foundation for expansion in the distant future.

85

Name: Cupit, Mamie

Major: Psychology

Faculty Advisor: Carolyn Adams-Price, Psychology

Co-Author(s): Darby Mackenstadt

The Impact of Outness to Family and Healthcare Providers in LGB Older Adults

As the LGBTQ+ community grows, the body of research regarding LGBTQ+ experiences has also grown. While much research exists regarding LGBTQ+ youth, the older adults of the community have unique experiences regarding health and life satisfaction that have not been deeply examined. The current study examines 265 sexual minorities (LGB) ages 52 to 62 from Dr. Ian H. Meyer's study "Generations: A Study of the Life and Health of LGB People in a Changing Society, United States, 2016-2019." Of those studied, the mean age was 58 years old, 44% were women, and 56% were men. A one-way ANOVA was used to analyze the self-reported health and satisfaction with life of these individuals in comparison to their outness as Lesbian, Gay, or Bisexual to family members and healthcare providers. It was hypothesized that being out to both healthcare providers and family would result in higher life satisfaction and better physical health. It was found that those who were out to all of their healthcare providers experienced greater life satisfaction than those out to some providers and better general health than those only out to no providers. Regarding family, those who were out to all of their family members experienced greater life satisfaction than those out to most of their family and had better general health than those only out to some of their family. These results imply the importance of being out to one's health and well-being. To best understand these results, further research analyzing why being out as LGB relates to health ratings and life satisfaction is needed. While this study aimed to increase knowledge on older adults, the maximum age of participants was only 62 years old. Further research analyzing older adults ages 65 and older would help to improve this area of study.

86

Name: Davis, Alexandria

Major: Psychology

Faculty Advisor: Danielle Nadorff, Psychology

Co-Author(s): Chapman, L. A., Pittman, K., Lopez., A. R.

Attachment, Trauma History, and Perceived Discrimination as Predictors of Depression in Emerging Adults Raised by Grandparents

Grandfamilies are formed when parents are unwilling or unable to care for their children, which is often a byproduct of a traumatic experience such as parental abandonment, abuse, or death. More than 5 million children resided with their grandparents in 2021, according to the United States Census Bureau. Limited research exists on this population in emerging adulthood. There is an increased vulnerability for depressive symptoms during this developmental stage. This may be especially true for children raised by grandparents, who are at a heightened risk for anxious attachment, trauma exposure, and depression. Racial and ethnic minorities comprise a large majority of grandfamilies in the United States, and this population reports high rates of perceived discrimination, which has been linked to depressive symptoms. Thus, understanding the specific risk predictors of depression in this population is of interest. University

students who were raised by grandparents were surveyed (N = 123). A multiple regression was run to predict depressive symptoms from perceived discrimination, anxious attachment, and trauma history in emerging adults raised by their grandparents. These variables significantly predicted depressive symptoms, explaining 27% of the variance $F(3,119) = 14.94$, $p < .001$, $R^2 = .27$. All variables added significantly to the prediction, $p < .05$. Results suggest that emerging adults are especially vulnerable to depressive symptoms, and that for those raised by grandparents, they may be at an elevated risk due to their history of attachment disruptions, trauma exposure and perceived discrimination. Development of community screenings and interventions for this population may be beneficial given the dearth of risk factors.

10

Name: Dill, Jane Alice

Major: Wildlife, Fisheries & Aquaculture

Faculty Advisor: Todd E. Mlsna, Chemistry

Co-Author(s): Prashan M. Rodrigo, Jac. J. Varco, Beatrice Arwenyo, Chanaka Navarathna

Funding: Food, Energy, and Water Security

Douglas fir Biochar Enriched Plant Nutrients as Controlled Release Fertilizer

Nitrogen (N), phosphorus (P), and potassium (K) are the macronutrients required for plant growth. Many agricultural soils worldwide contain deficiencies of either N, P, and/or K. The use of fertilizers with all primary macronutrients (N, P, K) can be costly and not readily available. NPK enriched biochar is a relatively cost-effective and eco-friendly source. Here, NPK-enriched biochar fertilizer (NPK/BC) was prepared using chemical co-precipitation of magnesium ammonium phosphate and magnesium potassium phosphate on Douglas fir biochar. NPK/BC has 43.76 mg/g of NH_4^+ , 120.14 mg/g of PO_4^{3-} , 3.79 mg/g of K^+ , and 34.05 mg/g of Mg^{2+} . The NPK ratios in the biochar are 3.4, 9.0, and 0.4, respectively. A pH range of 3-11 didn't affect the leaching of NH_4^+ , PO_4^{3-} and K^+ in distilled water, and their leaching was studied in different water matrixes at different temperatures (5, 25, and 40°C). NPK/BC can also act as an adsorbent material to remove heavy metals, anions, and organic contaminants. Here, the leaching of NH_4^+ , PO_4^{3-} , K^+ , and Mg^{2+} were studied in the presence of Cu^{2+} , Pb^{2+} , UO_2^{2+} , F^- , and methylene blue with 100 mg/L initial concentration and their removal. A greenhouse study was carried out to find the performance of NPK/BC for Corn with different treatments. Here, the amounts of NPK/BC were varied to have P rate of 0.00 (control), 26.50, and 53.00 Pounds/acre. Rates of K_2O , Mg, lime, and micronutrient (frit) were adjusted to 44.61, 17.84, 446.09, and 20.00 Pounds/acre, respectively, in all treatments. Performances of NPK/BC compared with different controls such as soil, synthetic fertilizers, and untreated biochar. A continuous-flow fixed-bed column study was carried out to compare the leaching rates of NH_4^+ , PO_4^{3-} , K^+ , and Mg^{2+} of synthetic fertilizer and NPK/BC fertilizer. This study proved NPK/BC could be utilized as a slow-release fertilizer.

169

Name: Doan, Leon

Major: Computer Science

Faculty Advisor: Vitor Souza Martins, Agricultural and Biological Engineering

Funding: MS NASA RID (award n: 23-12-12)

Leveraging GIS Tools to Improve Water Quality Visualizations with NASA Landsat Satellite Imagery

This NASA funded project aims to leverage NASA Landsat and ESA Sentinel satellites to improve water quality monitoring, and a relevant part of this project is to promote the results using GIS visualization tool. Landsat provides medium-resolution imagery that can be used to monitor water quality by measuring the reflectance of light in different wavelengths and modeling this reflectance with water quality parameters. However, interpreting and visualizing the data can be challenging without the use of GIS webtools. The project involves the collection of Landsat satellite imagery over a study area, the Gulf of Mexico, in combination with water quality data such as turbidity, and performs the image processing to be easily to use by end-users. Utilizing ArcGIS Dashboard, interactive visualizations were created that allow users to explore water quality data across the study area. The dashboard includes dynamic charts, graphs, and maps that provide information on water quality parameters such as turbidity. The results showed that the ArcGIS Dashboard improved the visualization of water quality data and provided a user-friendly interface for exploring complex data sets. Overall, this project demonstrates the potential of ArcGIS Dashboard in leveraging satellite imagery to improve water quality monitoring and visualization. Future projects can explore the scalability and generalizability of this approach in other areas and for other water quality parameters.

170

Name: Dominici, Brooke

Major: Natural Resource & Environmental Conservation

Faculty Advisor: Courtney Siegert, Forestry

Funding: Department of Energy- Poplar in the Southeast for Integrated Ecosystem Services

Effect of short-rotation woody crop riparian buffers on nitrate and ammonia mitigation

Nitrogen runoff from agriculture can cause water quality degradation and increase risks of eutrophication in downstream water bodies. A significant amount of nitrogen can be taken up by trees planted in riparian areas alongside agricultural fields, contributing to reduction in fertilizer runoff. One such system where this relationship may be leveraged is short rotation woody bioenergy crops such as *Populus* spp. and their hybrids. In this study, the nitrogen mitigation potential of agricultural runoff by eastern cottonwood (*Populus deltoides* clones S7C8, 110412 both clones interplanted) were tested at four study sites in Mississippi. Ion exchange resin bags were buried 0.5 meters deep in each of the test plots and in agricultural fields for an average of 106 days during the growing season. Clones were selected based on previous research demonstrating variable nitrogen use efficiency (S7C8 = high, 110412 = low). Prior to crop harvest, ion exchange resin bags were retrieved from the field, the resin was removed from the bags, the accumulated nitrogen was extracted from the resin, and the extraction solution analyzed for nitrate and ammonia. On average, tree plots reduced soil nitrate concentrations by 34% and soil ammonia by 42% relative to concentrations in agricultural soils across all study sites. Clone S7C8 reduced nitrate concentrations by 32% and ammonia concentrations by 34%. Clone 110412 reduced nitrate concentrations by 42% and ammonia concentrations by 40%. Finally, the plots that had a mix of hybrid S7C8 and 11042 reduced nitrate concentrations by 29% and ammonia concentrations by 51%. Results demonstrate that short rotation woody crops are important in mitigating nitrate and ammonia runoff from farm fields. Furthermore, functional traits such as nitrogen use efficiency did not impact mitigation potential. As such, planting short rotation woody crops at the interface of agriculture and riparian areas may be an option to protect water quality and diversify cropping systems.

171

Name: Douell, Olivia

Major: Wildlife, Fisheries & Aquaculture

Faculty Advisor: Brian Davis, Wildlife, Fisheries, and Aquaculture

Co-Author(s): Riley D. Porter, Eric J. Taylor

Funding: College of Agriculture and Life Sciences URSP

Reproduction in Boreal Owls (*Aegolius funereus*) using nest boxes in the Chena River System, central Alaska, 1997-2022.

The Boreal Owl is a small (20-23 cm long; 8-9 in.) solitary secondary cavity-nesting bird, primarily nesting in woodpecker excavated holes in closed-canopy forests. Trends in cavity use, clutch size, and nest success may be influenced by predation events, prey abundance, and other ecological factors. Here, we report on a long-term (1997-2022) study of nesting Boreal Owls in the Chena River system of central Alaska. We have data for 18 years; owl data were not collected in 8 of 26 years for various reasons. Total number of nests found was 153, ranging from 2-17 per year ($\bar{x}=8.5$). We found a total of 760 eggs across all nests ($n=153$), averaging 4.96 (range 4.0-5.6) eggs/clutch. Egg hatching success, or clutches where >1 egg hatched, was 70.4% (range 40.9-96.9%) across all nest-years. A total of 433 fledglings were produced from 153 nests; in 11 of 18 years when clutch sizes averaged <5 eggs/clutch, there were 2.09 fledglings/nest. In 7 of 18 years when clutch sizes averaged >5 eggs/clutch, there were 3.22 fledglings/nest. We detected a negative trend ($y = -0.0352x + 79.153$) in nests over time, although the relationship was weak ($R^2 = 0.0058$). Trends in nesting populations in northern Sweden, for example, declined from approximately 50% nest box use to just over 10% from 1980 to 2010. Predation on nesting owls, or decline in the primary prey, voles, may be responsible for Swedish trends. We will further investigate our data and examine box occupancy relative to other common cavity-nesters (e.g., common goldeneyes [*Bucephala clangula*]), predation events, philopatry of breeding females, and other factors such as clutch size and nest success in our study area compared with other North American and European Boreal Owl populations. Our research represents one of the first long-term nesting studies for this species in interior Alaska.

172

Name: Doughty, Baylor

Major: Forestry

Faculty Advisor: Adam Polinko, Forestry

Funding: College of Forest Resources Undergraduate Research Scholars Program

Effects of Fertilization and Endophyte Application on Growth of Planted Longleaf Pine

Longleaf pine (*Pinus palustris*) is an important economic and ecological species in the Southeast. However, it is often overlooked for replanting because of the slow growth associated with the physiological adaptation known as the "grass stage". During this stage, longleaf pine puts on minimal height growth and instead allocates resources to establish a healthy root system. Longleaf pine is fire adapted with thick bark, the ability to resprout its crown following fire, and rapid growth after emerging from the grass stage. The removal of fire from Southern forests and preference for faster growing loblolly pine (*Pinus taeda*) has resulted in a major decrease of the range of longleaf pine. This study investigates different fertilization methods to reduce time in the grass stage and initiate earlier height and diameter growth in longleaf pine. The site is located near Quitman, Mississippi near the northern edge of longleaf pine's native range. Soils on the site consist of a mix of fine sands, and sandy clays. A total of four treatments were applied in a randomized complete block design to a recently clearcut stand. Treatments included control, broadcast fertilizer (NPK 32-14-5) applied at a rate of

at 35lbs/ac., RTI (Silva Pak Worm Blend) controlled release fertilizer bags (NPS 19-8-3) applied adjacent to each seedling, and Intrinsic bio diazotrophic endophytes applied adjacent to each planted seedling. Two years following establishment, we measured root collar diameter (RCD), survival, vigor, and bolting of the seedlings. Vigor, RCD, and bolting did not show a significant difference during second year measurements. However, survival did show a significant difference. All current results will be discussed at the symposium. Reducing the time of the grass stage in longleaf pine will result in the reestablishment of longleaf to its native range and increase ecological diversity across the Southeast.

87

Name: Driggers, Amelia

Major: Biomedical Engineering

Faculty Advisor: David Buys, Food Science, Nutrition, and Health Promotion

Co-Author(s): Richard Kennedy

Changes in Life-Space with Loss of Relatives and Friends among Older Adults: Results from the UAB Study of Aging

Increasing age brings greater risk of the death of friends and family (hereafter referred to as loss). Loss may impact individuals' life-space mobility (LSM); however, no research has explored relationships between loss and LSM trajectories. Using the UAB Study of Aging, we examined differences in LSM trajectories of 1000 community-dwelling older Alabamians (65+years) with and without loss during the study period. We assessed LSM using the UAB Life-Space Assessment (LSA), a validated instrument measuring individuals' ability to move through zones ranging from their bedroom to out of town. We assessed loss every 6 months using a standard bereavement questionnaire capturing spousal, other relative, or friend loss. We used piecewise linear mixed effects models to compare LSA trajectories. Those who do not experience loss had a baseline mean LSA score of 49.5 and show a decline of 0.08 points per year ($p < 0.001$). Those that do experience loss had a baseline LSA score of 60 and decline by 1.0 point per year before the loss ($p < 0.001$), accelerating to 1.8 points per year after the loss ($p < 0.001$). Those with loss do not experience acute decline post loss but do have an acceleration of the pre-existing decline. More research is needed on this topic to better understand the impact of loss on LSM trajectories; but this finding suggests that more public health and clinical interventions may be needed for those who experience loss. Specifically, bereaved individuals may benefit from social, mental, or healthcare services for loss-related challenges.

88

Name: DuBose-Schmitt, Evelyn

Major: Food Science, Nutrition, and Health Promotion

Faculty Advisor: Alisha Hardman, School of Human Sciences

Co-Author(s): Marina D. Denny

Funding: USDA NIFA AFRI ELI Research and Extension Experiential Learning for Undergraduates (REEU) Fellowships Program

Development of Food Safety Assessment

Administering a competency assessment tool with newly hired and seasoned Extension agents can be used to tailor professional development opportunities. University of Tennessee (UT) Extension developed a framework and assessment for evaluating competency of FCS Extension Agents. The framework identified four knowledge areas, one of which, Food Safety, is discussed in this presentation. Each knowledge area is divided into concepts, which are further divided into competencies. For instance, the Food Safety knowledge area consists of two concepts, then is divided into nine competencies. Previous research (i.e., survey, focus group) examined whether this FCS competency framework was relevant to Mississippi. As a result of that research, the area was modified by adding five competencies and combining a couple of others, resulting in a total of nine competencies. The purpose of this part of the study was to tailor the existing FCS competency assessment tool to the unique needs and programming priorities in Mississippi. Once the competency framework was modified, we began reviewing the accompanying assessment instrument to modify it to reflect the policies and agencies in Mississippi and reflect the competencies added and edited. There were twenty-four Food Safety items in the assessment from UT Extension. Seventeen provided questions were maintained, and twenty-one questions were added to create a thirty-eight-question assessment. This assessment included at least three questions per competency. The adaptations and additions to the original framework competency assessment provided by UT are presented in this poster, along with example assessment items. This poster demonstrates the importance of using a research-based process for adapting frameworks and assessments to ensure they meet the unique needs and programming priorities of the state where they will be implemented.

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Name: Duncan, Whitney

Major: Civil Engineering

Faculty Advisor: Saeed Rokoei, Building Construction Science

Teamwork in Perception in Engineering Programs through the Lens of Gender and Race

Teamwork is an important factor in the construction and engineering industry. Teamwork needs to be learned in school to help students better prepare for the real world. It was found that most curriculum is delivered individually to students with little to no team based assignments. This is because the lecture-based layout of most courses is not set up to promote teamwork and student collaboration. This study explored students' perceptions of different aspects of teamwork. A survey on different aspects of teamwork was delivered to construction, biomedical, and mechanical engineering students in Fall of 2022. With these results, a quantitative approach was taken to analyze essential facets of teamwork and provide background for more exploration. Similarities and differences between gender-based students' perceptions were analyzed. Next, distinctions among students from underrepresented groups' perception responses were highlighted. Key aspects of teamwork were discovered that can now be incorporated into university curriculum. Furthermore, barriers and shortcomings in team-based practices and activities are discussed. Educators can use this paper to develop opportunities to inclusively develop teamwork skill sets in engineering students.

90

Name: Duncan, Whitney

Major: Civil Engineering

Faculty Advisor: Saeed Rokoei, Building Construction Science

Teamwork as a Core Competence in Construction and Engineering Education

Close collaboration between several parties has become prevalent in professional networks. Because of technology, different forms of teamwork are utilized throughout construction and engineering positions. Teamwork is an interpersonal skill and is increasingly gaining more attention in the workplace. Because of this construction and engineering programs should be preparing students with knowledge and experience in teamwork skill sets. The status of teamwork among construction and engineering students was explored in Fall of 2022. The goal of the study was to research various aspects of teamwork perceived by students. Biomedical and mechanical engineering students were selected to take a quantitatively designed survey. Common themes between the two groups were found and distinctions were highlighted. Then, a group-based analysis of teamwork perception and application was conducted with a similar approach. Key aspects of team based projects and practices were addressed for developing course components.

173

Name: Dunne, Reese

Major: Mechanical Engineering

Faculty Advisor: Matthew Priddy, Mechanical Engineering

Co-Author(s): Doyl Dickel, Addison Green, Dam Kim

Development and implementation of a magnesium-based finite element degradation model for hydroxyapatite-coated orthopedic implants

The emergence of degradable bone implants in a surgical setting could have significant impacts for the future of orthopedic implants, reducing the need for an implant removal surgery and minimizing pain associated with long-term titanium implants. Magnesium (Mg) is explored as a potential biomaterial for degradable implants due to similarities in mechanical properties to native bone. Previous *in vitro* studies have determined the degradation rate of Mg to be relatively fast when compared to bone regeneration. Recent studies have explored hydroxyapatite (HA), the mineral component of bone, as a surface coating on Mg implants to slow and control degradation rate. Therefore, this work aims to develop and implement a finite element degradation model for HA-coated Mg alloys that can be used with fully dense and open cell geometries. The damage evolution law for pitting corrosion is used to model and predict the degradation of pure Mg. Finite element analysis is performed on a cylindrical Mg specimen (D=25.4mm, H=8mm) through Abaqus/Standard software to incrementally monitor the damage value of each Mg element and subsequently delete fully-degraded elements from the simulation. A Fortran user-material (UMAT) subroutine assigns each element a pitting parameter, controlling the rate of degradation throughout the simulation and providing necessary input of pure Mg and HA elastic material properties and degradation model parameters into Abaqus. The simulations allowed for the visualization of both pure Mg and HA-coated Mg degradation over a 30-day period, displaying slower corrosion rates for HA-coated Mg and other expected degradation trends. Simulation methodology and results have been calibrated with published experimental degradation studies. This calibrated degradation model can be further extended to other Mg alloys and geometries, emphasizing the important role of computational modeling paired with *in vitro* degradation studies to ultimately use HA-coated pure Mg as a biomaterial for synthesizing patient-specific, degradable orthopedic implants.

11

Name: Dutra, Bonnie

Major: Food Science, Nutrition, & Health Promotion

Faculty Advisor: Cory Gallo, Landscape Architecture

Funding: College of Agriculture and Life Sciences URSP

Production and Safety in Student Lead Farms and How They Prepare Students for Industry

Student farms were once few and far between but have shown an increase in not only abundance but also necessity throughout the United States. Pioneering educational developments and land grant institutions were significant factors in successfully implementing these student-led projects. A student farm provides hands-on experience in an industry setting and prepares students for their future careers. By utilizing student research, labor, marketing, and communication skills, these farms are an invaluable asset to providing an experiential learning option for students in their future professional community. Student-led farms provide a guided window of opportunity for students without industry background to learn skills necessary in the food industry's career field. These environments are openings for the industry to relay current issues and technological breakthroughs to provide a consistently updated view of the industry. By creating and maintaining student-led farms, students who graduate into the industry are ready to "hit the ground running" with an already up-to-date view of current issues, technologies, and day-to-day scenarios. Research shows that students are better prepared to enter the food industry upon graduation when having experience with vegetable and fruit production, within realistic industry standards. These studies have shown that by fostering an imitation productive environment, students are better equipped to understand and work through industrial issues, with their given experiences at the student farms. The importance of creating as close to an industry-standard environment is that creating unsuitable environments does not adequately prepare students, researchers, or other industry professionals due to the lack of useable data and analyses.

56

Name: Easter, Madeline

Major: Landscape Architecture

Faculty Advisor: Chuo Li, Landscape Architecture

Funding: College of Agriculture and Life Sciences URSP

Opportunities and Challenges of Urban Agriculture in Landscape Design: Lafayette Greens

Urban agriculture (UA) has increasingly been considered an essential form of urban green infrastructure in the past decade. In addition to production functions, UA offers a wide range of ecological, socio-economic, and cultural benefits and promotes food security, health and nutrition, and community enrichment for urban dwellers. Acknowledging the multiple infrastructural functions of UA, many cities have started to consider UA a legitimate concern of city planning and revise land use policies to renew the commitment of UA (Mendes et al. 2008). Despite the considerable evidence for its various benefits, integrating UA into the urban green infrastructure is a relatively new concept in city planning and academia. Our understanding of its practice and potential impact still needs to be improved. It remains unclear what the reasons for urban designers' low involvement in urban food system issues are and the major obstacles for landscape architects to integrate UA into their urban projects. This study used a case study method to analyze an award-winning park known as Lafayette Greens in Detroit, MI, which used UA as a significant component of its design. By conducting interviews with the experts involved in the creation and post-occupancy of Lafayette Greens, this study found that funding and community involvement help to create thriving urban agriculture. These findings suggest that funding from the local government and private corporations contributes to the success of urban agriculture spaces. In addition, participatory planning encourages community involvement and ownership, which is essential for incorporating UA in public parks. The results shed light on the future planning and design practices that lead to the successful incorporation of UA in public spaces. The cities should place a higher priority on UA development with more funding opportunities and policy support. In addition, involving the communities in the planning and decision-making process encourages stewardship toward UA management and maintenance. This study contributes to understanding the challenges of the spatial aspects of designing and maintaining UA in the public space. It emphasizes the role of urban planners and designers could play in promoting food resilience and sustainability in our cities.

91

Name: Eaton, Genevieve

Major: Human Development & Family Science

Faculty Advisor: JuYoung Lee, Human Sciences

Co-Author(s): Anna Donnelly, Macy Johnson, Madeline Link

How Our Psychosocial Stages in Adulthood Affect the Way We Purchase Sustainable Products

The growing interest in sustainable products has a lot of businesses changing their marketing strategies. So many products have been released as "organic" or "clean". A topic that has not yet been explored is who should be the target audience for these sustainable products. Erik Erikson's Theory of Psychosocial Development gives us an insight on the internal "crisis" that each stage in life brings.

Research has shown that the two stages we are in the majority of our adult life is Intimacy vs. Isolation (18-40 years old) and Generativity vs. Stagnation (40-65 years old). In this study, we will be using Erikson's theory to justify how people make decisions on purchasing sustainable products. We predict that the adults in the developmental stage of Generativity vs. Stagnation will be more likely to purchase sustainable products because they are in the crisis of how they can contribute to society. To perform this research, we will be conducting a survey using Qualtrics. Participants will answer questions such as age, socioeconomic status, how often they purchase sustainable products, why they make those purchases, etc.

92

Name: Edwards, Grayson

Major: Psychology

Faculty Advisor: Hallie Smith, Counseling, Educational Psychology, & Foundations

Co-Author(s): Mary Eliza McCarley

Caregiver Training Using Video Modeling and Feedback

Caregiver involvement is necessary to the success of treatments for children with pediatric feeding disorders. While therapists spend countless hours with the child evaluating and implementing effective treatment protocols, it is the ultimate goal for behavior analysts to train caregivers to successfully implement treatment protocols with their own child in their own home. One strategy commonly used to train caregivers is behavioral skills training (BST). BST involves providing direct instruction on the steps of the protocol, modeling the correct implementation of the steps to the caregiver, and providing the caregiver with the opportunity to practice the protocol with a confederate while receiving feedback from the therapist. While we know that this is an effective method of caregiver training, it can be time consuming and can require repetition. Video modeling has been more recently explored in the literature and has been shown to be a viable option for caregiver and staff training; however, the use of video modeling to train caregivers to implement a feeding protocol has not been explored. The purpose of the current study was to evaluate the effectiveness of video modeling plus feedback on caregiver treatment fidelity of a multi-step behavior analytic feeding protocol. Training was provided to the child's mother by two graduate students and involved the presentation of a task analysis (a detailed explanation of each step that needed to take place within the protocol) combined with watching a 3-minute video of a trained therapist implementing the protocol with her child; feedback and modeling were provided only if she implemented steps incorrectly or missed a step. Ultimately, this model of caregiver training took less than 30 minutes of therapy time and resulted in rapid acquisition of the feeding protocol with high treatment fidelity.

174

Name: Eisenhuth, Madison

Major: Wildlife, Fisheries & Aquaculture

Faculty Advisor: Peter J. Allen, Wildlife, Fisheries & Aquaculture

Funding: College of Agriculture and Life Sciences URSP

Hematology of Redear Sunfish (*Lepomis microlophus*)

Redear Sunfish (*Lepomis microlophus*) is a freshwater species belonging to the Centrarchidae family that is widespread in natural waterways, recreational ponds, and aquaculture ponds of North America. Despite its importance, little research has been conducted on this species, including basic research to develop a better understanding of normal blood conditions to create a profile for healthy fish. Therefore, blood was collected from 11 adult Redear Sunfish and measured for: pH, hematocrit, hemoglobin, and red blood cell concentration (manual and automated methods). Using these measurements, mean corpuscular volume, mean corpuscular hemoglobin, and mean corpuscular hemoglobin concentration were calculated. Values were compared to other species in the Centrarchidae family. Values differed from some species; mean \pm standard error hematocrit was $37.7 \pm 0.03\%$ and corpuscular hemoglobin concentration was 29.03 ± 1.39 g/dL. In contrast, bluegill (*Lepomis microchimus*) have reported hematocrit of 28% and mean corpuscular hemoglobin concentration of 20.7 g/dL. This information will be beneficial for providing a baseline of knowledge about healthy Redear Sunfish useful for field work and cultivation in an aquaculture setting, where this species is also often used to control mollusks and reduce disease transmission.

57

Name: Enriquez, Jacqueline

Major: Architecture

Faculty Advisor: Silvina Lopez Barrera, School of Architecture

The Evolution of Indigenous Architecture in Mexico

Indigenous architecture technologies and techniques have been developed to accommodate the needs of local people responding to specific conditions of the environment, climate, and availability of local materials. These technologies and techniques provided solutions to the indigenous people in creating thermal comfort for their own homes. Mexico is one of the countries with different regions of dry and humid climates where temperatures rise more than 80 degrees daily. Countries in high-climate regions find it difficult to sustain

thermal comfort within homes because of the rising temperatures. Modern building techniques have been known to use energy-based active technologies whereas indigenous techniques use natural materials and passive cooling methods to provide a comfortable home environment. In modern homes, cooling techniques consume more energy than in indigenous vernacular homes increasing energy costs. While indigenous methods are not widely spread in modern times, they are low-cost sustainable solutions that can be used in low-income communities and beyond. The goal is to study affordable and low-cost solutions in residential buildings using indigenous techniques to improve indoor environmental quality. This paper analyzes case studies of indigenous architecture including adobe homes and troglodyte dwellings and the use of local materials such as sun-dried brick, kiln-fired brick, and terracotta roof tiles to maintain interior thermal comfort. Findings suggest that some indigenous techniques are applied in contemporary Mexican architecture to achieve thermal comfort. Indigenous passive cooling techniques, roofing, ventilation systems, and the use natural of materials are commonly used for thermal comfort in Mexican homes. Finally, this paper contributes to a broader discussion of how indigenous architecture has contributed to the evolution of modern Mexican architecture and its sustainable design.

175

Name: Fair, Jack

Major: Forestry

Faculty Advisor: Ashley Schulz, Forestry

Funding: ORED Undergraduate Research Program

A dendrochronological study of how prescribed burning affects long-term tree growth trends in John W. Starr Memorial Forest

Fire is an important disturbance agent that reduces coarse and fine fuels, wildfire risk, and plant competition, and promotes decomposition, nutrient cycling, and plant growth in North American forest ecosystems. Many tree species, including pines, are adapted to and benefit from prescribed fire as part of a short- and long-term forest management plan. Studies of ponderosa pine (*Pinus ponderosa*) in the western United States and longleaf pine (*P. palustris*) in the southeastern United States have demonstrated the positive relationship between prescribed fire and tree growth rate. Here, we aimed to test this hypothesis by comparing growth rate before and after prescribed burning in two loblolly pine (*P. taeda*) stands with known fire management history from 2020 in the J.W. Starr Memorial Forest southwest of Starkville, Mississippi. In each stand, we randomly sampled six, 12.62m radius plots in which we collected two increment cores from the North and East sides of one codominant loblolly pine tree per plot. We also collected stand metrics, such as diameter at breast height and azimuth of other trees in the plot, as well as soil type. Tree cores were placed into a paper straw with an identification number and transported to the lab at Mississippi State University, where they were refrigerated before being dried, glued, and sanded for analysis and digitization. Results from this study will be presented and discussed. We expect to find that, in each plot and stand, tree growth rate significantly increased after prescribed burning in spring 2020 as compared to growth rate prior to burning. Ultimately, the results from this research will shed light on the management practices that best promote tree growth and vigor in loblolly pine stands in the southeastern United States.

176

Name: Farmer, Brayden

Major: Aerospace Engineering

Faculty Advisor: Shreyas Narsipur, Aerospace Engineering

Co-Author(s): Maggie Hargrove, Logan Martin, Colby Walker

The Effects of Flutter with Different Wing Designs

In this paper flutter is investigated using a previous study by NASA as a basis to understand how different wing designs affect flutter. This investigation utilizes two methodologies for analysis: Computational and Experimental. ANSYS is used to create a time transient model for fluid structure interaction. Experimentally, a scaled model is created to be analyzed in a wind tunnel.

93

Name: Farnlacher, Emma

Major: Animal and Dairy Science

Faculty Advisor: Molly Nicodemus, Animal and Dairy Sciences

Co-Author(s): Molly Friend, Katie Holtcamp, Jordan Ray, Rebecca Swanson, Caleb Lemley

Funding: College of Agriculture and Life Sciences URSP

Pilot Study: A comparison of short-term experiential group therapy and psychotherapy incorporating equines in college students without a mental health diagnosis

After the COVID-19 pandemic, college students struggled with returning to a pre-pandemic academic routine. While students may not have been diagnosed with a mental health disorder, this transition did create perceived anxiety and stress according to campus counseling services. Although traditional group therapy holds value in supporting the mental health needs of students, the emergence

of research valuing the impact of psychotherapy incorporating equine interaction (PIE) has drawn attention as a potential therapeutic alternative. Furthermore, research investigating PIE documented improvements in as little as two weeks in college-aged adults with substance abuse disorder, thus, indicating the promise of a more efficient therapeutic intervention. Therefore, the objective of this study was to investigate the impacts of short-term experiential group therapy compared to PIE on cortisol concentrations in college students without a diagnosed mental health disorder. Students were recruited by a local therapy program working with the University during the fall 2022 semester. Participation required full-time students that were not diagnosed with a mental health disorder. Participants (n=3) underwent two morning sessions of each therapy type (experiential group therapy and PIE) for two weeks. Salivary cortisol samples were collected less than 10 minutes before and after each therapy session for each therapy type. Data were examined for significant variation of cortisol concentrations between therapy types with level of significance at $P \leq 0.05$. No significant differences were found in the concentrations of cortisol between therapy types ($P=0.193$), week of therapy ($P=0.686$), or therapy type by week interactions ($P=0.858$) during the therapy period, thus, indicating experiential group therapy does not present an advantage over PIE within a short-term mental health program. In closing, as campuses look to address student mental health, research similar to this study should be implemented to investigate what interventions hold promise in supporting the needs of students.

177

Name: Feduccia, James

Major: Biochemistry

Faculty Advisor: Xueyan Shan, Biochemistry, Molecular Biology, Entomology, and Plant Pathology.

Funding: College of Agriculture and Life Sciences URSP

Antimicrobial Peptides as a source of *Aspergillus flavus* resistance

Aspergillus flavus is a grain infesting pathogenic fungus that produces carcinogenic aflatoxin, ruining infected bushels that are to be used for domestic products or for export. When aflatoxin is found above the allowed threshold the crop cannot be used and is considered waste. Alternatively to using pesticides that are potentially harmful to the environment and to humans, we are seeking to produce crops that have the capability to produce their own resistance through naturally evolved immunity as to prevent the waste of corn crop. Quantitative trait loci studies have produced resistant and susceptible strains of corn that have been analyzed to identify genetic regions of interest. Within the QTLs exist antimicrobial peptides (AMPs), short amino acid sequences that are toxic to some microorganisms, that are of interest to us. Using PCR, we have identified AMPs that present polymorphisms between the resistant and susceptible strains including defensins, several uncharacterized cyclotides, and heveins, one of which is a chitinase. We then decided to clone these peptides so that they can be translated, extracted, and introduced to *A. flavus* cultures. By examining the direct effect these peptides have on *A. flavus* we hope to better understand the resistance trait in *Zea mays* against *A. flavus*. We hypothesize that introduction of these peptides into *A. flavus* culture will prevent growth and cause death to the pathogen at predicted physiological concentrations.

69

Name: Ferrell, Carly

Major: Mathematics

Faculty Advisor: Andrew Jarosz, Psychology

Funding: Shackouls Honors College Research Fellowship

Sight Singing and Working Memory Capacity

Sight singing (i.e., singing a novel melody from sheet music given only a few moments to prepare) is a skill required to be a competent musician. As with all skills, sight singing ability improves with practice and expertise, but this skill may come more easily for some than others. Much of the current literature suggests a positive relationship between working memory capacity (WMC) and various musical skills, such as sight reading ability of pianists; however, sight singing requires certain capabilities that playing an instrument does not, such as simultaneously reading lyrics. Thus, a closer look at sight singing in particular is required. The present study examined this relationship by evaluating the WMC and sight singing ability of vocalists from a wide range of sight singing skill (amateur to expert). Participants performed 27 total sight singing exercises, which varied in difficulty. While the first 12 exercises were traditional sight singing excerpts, 6 exercises solely measured rhythm ability; another 6 measured solely pitch ability; and the final 3 exercises measured lyric-reading ability while sight singing. Following this, participants completed the symmetry span, operation span, and reading span tasks, all of which measure WMC. Finally, participants completed a survey detailing their musical experience. Findings from this study can be used in entry-level aural skills or ear training courses, where music students first learn to sight sing; if higher WMC amateurs outperform those with lower WMC on a sight-singing task, then these individual differences can be accounted for to better help novices succeed.

94

Name: Fischtzur, Caitlyn

Major: Psychology

Faculty Advisor: Arazais Oliveros, Psychology

Adversity and Resilience Training 2.0

From January to June 2022, Child Advocacy Centers in Mississippi served 2,845 children who have experienced maltreatment (National Children's Alliance, 2022). Given the promising results of Adversity and Resilience Training (ART; Dumessa, 2020) a 3-hour workshop developed to increase awareness of Adverse Childhood Experiences (ACEs) and trauma-informed care (TIC), the current study seeks to adapt the training to an online learning context via self-paced modules that increase access to adult learners in child-serving fields. Learning objectives include (1) knowledge of ACEs and traumatic stress (2) understanding National Child Traumatic Stress Network's "12 Core Concepts to Understanding Child Maltreatment and Trauma" and identifying them in sample case scenarios; (3) recognizing secondary traumatic stress and generating a trauma-informed self-care plan; and (4) improved attitudes favoring TIC. Before participants exit the course, they also access a list of resources that can help them continue to develop competencies in traumatic stress response and promoting resilience in the children they serve. Recruitment will target child-serving professionals and pre-professionals (i.e., completing field experience/internships). Impact of the training will be assessed via participant responses to pre- and post-training questionnaires regarding ACEs, resilience factors, perceived trauma knowledge, objective trauma knowledge (12 core concepts), attributions regarding difficult child behaviors, and attitudes regarding TIC. Finally, they are asked to provide a fake name so that their pre and post scores will be compared to test knowledge uptake, trauma-informed attitudes and attribution changes. Their follow-up surveys assess if they are continuing their self-care plan. Results will indicate the feasibility and impact of a scalable training program for workforce development delivered virtually.

178

Name: Flynn, Darrock

Major: Mechanical Engineering

Faculty Advisor: Matthew W. Priddy, Mechanical Engineering

Co-Author(s): Alexis Graham, Amirtaha Taebi, Lauren Priddy

Funding: NIH R25

Computational Fluid Dynamics in a Perfusion Bioreactor

Mechanical bioreactors have shown much promise for studying cell growth in 3D bone structures via perfusion. Fluid flow is extremely important in these studies because media perfuses through the porous bone, providing nutrients to the cells and stimulating growth. However, media flow is inconsistent throughout the bioreactor due to the placement of the inlet/outlet of the chamber and perfusion through the bone is quite heterogeneous. This study examines the fluid flow around and through specimens simulating trabecular pig bone from the femoral head with computational fluid dynamics (CFD) simulations. This work utilizes Ansys Fluent to mesh the bioreactor and simulate fluid flow through the device to calculate shear stresses, strain rates, and changes in flow throughout the model. The desired media flow through the bioreactor is 1mL per minute and expectations are to show 1500-3500 micro strain along the bone to promote bone growth. Ansys provides a visual representation of streamlines, velocity gradients, and stress or strain contours throughout the bioreactor. This data will be used to validate the physical properties required for bone growth in physical experiments.

179

Name: Foley, Connor

Major: Biochemistry

Faculty Advisor: Priyadarshini Chakrabarti Basu, Biochemistry, Molecular Biology, Entomology and Plant Pathology

Co-Author(s): Dawson Boes

Funding: ORED Undergraduate Research Program

Developing a Computer Vision Algorithm for Monitoring Colony Strength in Honeybees

Monitoring colony strength is essential to beekeeping as well as to pollination and apiculture research. The number of foraging honeybees returning to the colony with pollen and the total number of returning foragers are both accurate indicators of colony strength. While maintaining their colonies, beekeepers often glance at or around the entrances of their hives to gain a relative understanding of colony health. However, the accuracy of a cursory check varies even throughout the same day and is not rigorous. For research, scientists often set up a camera at a colony entrance to record the incoming foragers. Once videos have been collected, they typically spend hundreds of hours manually analyzing the data. Thus, rigorously estimating the indicators is very time consuming and labor intensive for humans. To overcome these difficulties, strategies ranging from simply standing near a hive and counting foragers as they arrive to installing forager traps and AI enabled cameras at colony entrances have been tested. Among the most promising methods for health monitoring involve computer vision, the branch of AI related to visual problems. Proof of concepts have already

established that computer vision algorithms are an effective strategy for colony monitoring. However, these proofs do not differentiate between different castes or the presence of pollen. They also do not account for changing light and environmental conditions throughout the day. For this project, we seek to develop an algorithm capable of distinguishing both between castes or pollen presence and across changing light conditions with high accuracy. A significant aspect of this development is creating a representative and clean dataset. Presented here are the methods used and current state of the dataset. Early AI testing, discussion of its implications, and future directions are also included.

180

Name: Foster, Makenna

Major: Psychology

Faculty Advisor: Molly Nicodemus, Animal and Dairy Sciences

Co-Author(s): Ed North, Julius Culwell, Torea Williams

Pedigree tracing to determine origins of the Palomino Horse Breeders of America stock-type horse

Registration numbers for Palomino Horse Breeders of America (PHBA) have risen due to new guidelines allowing registration of any horse with a palomino body color even if pedigree is unknown. While this promotes registry growth, pedigree tracing can assist in documenting breed origins. Pedigree tracing is valuable for color registries as the study of coat colors is a relatively new science plagued with misunderstandings due to pedigrees with inaccurate color designations. The objective of this study was to develop a better understanding of the historical origins of today's PHBA stock-type horse through pedigree tracing. 800 horses were randomly sampled from published entries from 10 years of the PHBA World Show, however, only 460 samples were utilized due to the lack of verified documentation of extended pedigrees that included documented coat colors taken from the All-Breed Database. A complete record was defined as having an uninterrupted generation to generation inheritance pattern of a cream dilution gene influenced coat color from the sampled individual that directly traces back to the earliest existing recorded relative. Results found only 6 foundation sires are responsible for the modern PHBA stock-type horse. The majority of horses within the Hall of Fame have pedigrees that trace back to only one of these sires named Old Fred born in 1884. Two of the identified sires, Yellow Jacket in 1908 and Cotton Eyed Joe in 1936, were identified as obligate carriers due to conflicts concerning color designation because the recognized breed association at that time did not inspect and register with color identification and further documentation concerning color and offspring was conflicting. In conclusion, while breed origins were established, as PHBA grows, additional genetic testing to accurately identify the cream gene within registered horses will support the goals of a color registry that is based upon cream phenotype.

181

Name: Fowler, Cameron

Major: Industrial Engineering

Faculty Advisor: David Saucier, Center for Advanced Vehicular Systems

Funding: Athlete Engineering

Understanding body composition metrics in NCAA Division 1 athletes

Coaches and athletes are continuously working to get an edge over their competition. One tool they can use to learn more about the athletes' bodies and how it changes during the season is Dual-energy X-ray Absorptiometry (DXA) which provides body composition metrics on (1) bone mineral density (BMD), (2) body fat percentage, and (3) lean muscle mass distribution among other body composition variables. Nutritionists and strength and conditioning coaches can use this information to help determine the appropriate regimen to maximize the athlete's performance on the field. One example of this is if an athlete has a low BMD, they are at an increased risk of developing a stress fracture. A nutritionist and a strength and conditioning coach could then use this information to develop a diet and training regimen designed to build bone density. The purpose of this study is to understand the body composition variables that DXA outputs and their uses in nutrition and recovery of college athletes. This will be used to develop an initial concept dashboard that nutritionists and coaches can use to quickly understand the trends of an athlete and where they should focus on improvement or stabilization of an athlete's body composition metrics during the different mesocycles of a season.

182

Name: Gagliano, Sheraden

Major: Food Science, Nutrition, & Health Promotion

Faculty Advisor: Wen-Hsing Cheng, Food Science, Nutrition, and Health Promotion

Funding: College of Agriculture and Life Sciences URSP

Essential roles of SELENOH in insulin sensitivity at old age in mice

SELENOH is a selenium (Se)-sensitive selenoprotein with impaired expression under a suboptimal Se status. Being the sole nucleus-specific selenoprotein, it is thought to play a significant role in DNA damage and senescence responses to oxidative stress and has been

hypothesized to protect against age-related disorders. In this study, we investigated the impacts of SELENOH knockout on age-related insulin resistance in male wild-type (*Selenoh*^{+/+}), *Selenoh* heterozygous knockout (*Selenoh*^{+/-}), and *Selenoh* homozygous knockout (*Selenoh*^{-/-}) mice aged 9 and 18 months under the C57BL/6 genetic background (n = 6). Mice reached maturity and old age at 9 and 18 months, respectively. Mice were kept under specific-pathogen-free conditions in individually ventilated cages within an animal room (22 °C, 12-h dark: light cycle) and had ad libitum access to a Se-adequate chow diet and water until they were anesthetized with carbon dioxide and killed by exsanguination via cardiac puncture. The liver sample was collected and stored at -80°C for Western analysis. Liver thymoma viral proto-oncogene (AKT) phosphorylation on Threonine 308 was used as a marker of insulin sensitivity. Body Se status was determined by SELENOP, GPX1, and SELENOW protein levels. Results showed that, in comparison with *Selenoh*^{+/+} mice, AKT phosphorylation on Threonine 308 was greatly reduced in the liver of *Selenoh*^{+/-} and *Selenoh*^{-/-} mice aged 18 but not 9 months. Knockout of SELENOH did not influence levels of GPX1, SELENOP, or SELENOW in the liver. These results are consistent with earlier studies in our laboratory, demonstrating insulin resistance by dietary Se deficiency. In conclusion, SELENOH is necessary to maintain insulin sensitivity in the liver of old mice.

95

Name: Gandy, Anna

Faculty Advisor: Angela Robertson, Social Science Research Center

Evaluation of Mississippi's Impaired Driving Intervention

The Mississippi Alcohol Safety Education Program (MASEP) is a statewide, court mandated, evidence based impaired driving intervention program for people convicted of first offense driving under the influence (DUI). This study evaluates the participant's perception of the helpfulness of the MASEP program as well as changing substance use behaviors and reducing risk of recidivism. A pre/post-test research design was employed. Participants completed a survey at the beginning of the program and gave consent in the last meeting of the MASEP class to be contacted to complete a survey administered three months after the completion of the program. The follow-up survey, collected by phone and email, asked questions about one's experience in the class and behaviors they have engaged in after completing the program. A total of 941 follow-up surveys were collected. The vast majority (over 86%) of evaluation study participants reported that the program components and the instructors were very helpful and that they had reduced their substance use and impaired driving behaviors. For example, 81% reported that creating a DUI avoidance plan was helpful; 86% reported that their experience in MASEP helped them to avoid impaired driving. Almost all reported that they had not driven impaired since completing MASEP; 92% reported no alcohol impaired driving and 95% reported no drug impaired driving. The results of this evaluation indicate that the program is effective in improving participant knowledge, attitudes, and behaviors related to impaired driving.

12

Name: Garcia, Reyki

Major: Software Engineering and Mathematics

Faculty Advisor: Tian Wenmeng, Industrial and Systems Engineering

Funding: Privacy Preservation in In-Situ Additive Manufacturing Process Signals

Acoustic and Acceleration Physical Systems with Data-Driven Modeling in Additive Manufacturing

In additive manufacturing, process signals, such as acoustics and accelerometers, contain rich information for printing condition information. These signals can be captured to reversely infer printing path information, which are critical for product design. However, the capacity of different process signals to disclose printing path information is not fully understood in the literature. This study examines the printing path information contained in various process signals collected from a 3D printer during the fabrication process. An experimental setup was established to mount multiple sensors to the 3D printer for real-time process monitoring. A set of experiments were conducted during which process data were collected in real time. Subsequently, feature extraction was performed to evaluate the design information disclosure through those process signals. This holistic framework that characterizes the release of additive manufacturing design information can issue insights into the preservation in in-situ additive manufacturing process monitoring.

96

Name: Garcia, Sophia

Major: Kinesiology

Faculty Advisor: Megan E. Holmes, Kinesiology

Co-Author(s): Travione A. Smith, Ian C. Macali, Lauren K. Smith

Association of Dog-ownership with Physical Activity in Students Attending a Southeastern University

Background: Pet ownership has been shown to increase leisure time physical activity in owners compared to those who do not own a pet. This trend highlights pet ownership's impact on increasing physical activity levels. The pet's need for consistent walking and regular

playtime facilitates a more active regimen for the owner to meet physical activity requirements. Physical activity is beneficial for many health conditions due to its ability to reduce physical and psychological maladies. Some health benefits include reduced risk of cardiovascular disease, improved blood pressure levels, and better mental health. Basic caretaking, such as walking or playtime with a pet, encourages more physical activity for the owner and also establishes companionship between the pet and the owner. This study examines the association between pet ownership status and physical activity levels among enrolled college students. Methods: Participants will be university students and will be queried regarding their pet ownership status using an online questionnaire. Basic demographics of participants, such as age, sex, race/ethnicity, height, weight, major in school, etc., will be surveyed. The International Physical Activity Questionnaire Short Form (IPAQ-SF) will also be a part of the online survey. The IPAQ is used to self-report participants' weekly moderate to vigorous physical activity levels, and comparisons will be made between those with and without dogs. In order to understand more about the dogs studied, the online questionnaire will include aspects pertaining to the dog, such as size, breed, age, and health status. We hypothesize that participants with dogs will have higher physical activity levels than those without. We also hypothesize that dog characteristics will influence the owner's physical activity. Owner characteristics such as major in school may also influence activity levels.

13

Name: Gautier, Charlie

Major: Aerospace Engineering

Faculty Advisor: Shreyas Narsipur, Aerospace Engineering

Co-Author(s): Campbell Taylor Brandon Means Jacob Rushing

The Aerodynamic Effect of Articulating Nose Cones on Subsonic Missile Flight

Initially inspired by birds of prey, the articulated forebody of axisymmetric flight vehicles offers to impact both maneuverability and cruise performance at various flight velocities and trajectories. This research seeks to evaluate, confirm, and expand upon previous research conducted with articulated missile forebodies at subsonic speeds through wind tunnel experimentation at Mississippi State University. Though former wind tunnel research on articulated forebodies featured exchanging multiple nose cone variants at differing angles of attack throughout testing, this study investigates an actively moving forebody through the use of an internal motor and microcontroller to collect data for an actuating specimen.

14

Name: Ginder, Finnis

Major: Chemical Engineering

Faculty Advisor: Julie Jessop, Dave C. Swalm School of Chemical Engineering

Co-Author(s): Sage Schissel

Funding: GOALI: Connecting the Dots: Using Radical-formation Control to Achieve Desired EB-initiated Polymer Properties

Mixing it up: Determining G-values for comonomer formulations

In electron-beam (EB) polymerizations, accelerated electrons are used to initiate free-radical polymerization of acrylate monomers for film and coating applications. Designing polymers synthesized by this fast and environmentally friendly method requires an understanding of radical formation reactions. Reactions producing primary radicals are the first step, and the yield of these radicals can be expressed as G-values, defined as the number of primary radicals formed per 100 electron volts (eV) delivered. In this research, a calibration curve has been developed relating the concentration of free radicals in a monomer solution to the UV-vis absorption spectrum of a free-radical scavenging dye. This calibration curve will be used to determine G-values for acrylate pure monomers and comonomer formulations undergoing EB irradiation. From these data, relationships predicting G-values of comonomer formulations and polymer crosslinking behavior will be developed. These structure-processing-property relationships will provide a fundamental basis to expand the commercial opportunities of EB polymerizations.

15

Name: Gomez, Gabriela

Major: Aerospace Engineering

Faculty Advisor: Like Li, Mechanical Engineering

Co-Author(s): David Korba

Funding: ORED Undergraduate Research Program, US Department of Energy

Computational Modeling of a High-temperature Moving-bed Oxidation Reactor for Thermochemical Energy Storage

As the repercussions of extended fossil fuel use become increasingly evident, renewable forms of power generation (solar, wind, wave, etc.) have gained significant interest. A major challenge of renewable power generation is in handling the inherent intermittency of their power sources (off-sun hours, low wind/wave weather conditions, etc.). Thermochemical energy storage (TCES) has shown promise as a

solution, in which generated heat from renewable sources drives an endothermic reaction during peak hours, converting thermal energy to chemical potential energy. The reverse reaction can be initiated on-demand to recover thermal energy as process heat or to feed a conventional power cycle when needed. Moving-bed reactors with inherent heat recuperation have recently attracted attention to facilitate this two-step process, allowing for near-room temperatures at reactor bounds and varied storage/extraction power rates depending on the TCES material flow rates. In this work, a three-dimensional (3D) moving-bed oxidation reactor (based on magnesium-manganese oxide) was remodeled to a two-dimensional (2D) axisymmetric version to simulate high-temperature heat extraction with temperatures greater than 1000 °C. The simulation follows a corresponding experimental setup, the data of which is used to validate the model. The results include characterization of the reactor efficiency, obtained with transient simulations that capture the energy and mass transfer within the reactor. A parametric study was also conducted with the 2D model by varying the reactor geometry and operating conditions. While the 3D model demonstrates increased accuracy, the reduced computational time of the 2D model makes it well-suited for parametric and optimization studies for future up-scaling. The presented results can provide insight into differences in accuracy between 2D and 3D modeling approaches for future pilot- and industrial-scale reactor designs.

183

Name: Gonzalez Lopez, Andrea

Major: Animal and Dairy Science

Faculty Advisor: Rhonda Vann, Animal and Dairy Sciences

Funding: College of Agriculture and Life Sciences URSP

Evaluation of live animal and carcass body composition traits in sheep for enhancing genetic predictors

In the sheep industry market lamb comprise eighty-five percent of the gross income of sheep enterprises. Establishing breeding stock with the most favorable body composition traits will enhance the gross income of sheep producers. Due to limited research in this area, it has yet to be proven that composition traits between the live animal and its carcass have a strong correlation and that both the left and right ribeyes on a sheep carcass vary in area per square inch. Therefore, our research objective is to prove that composition traits can assist in enhancing genetic predictors. Twelve sheep were evaluated in 2023, for ribeye area, backfat, loin depth, and intramuscular fat using ultrasound. These same traits were evaluated on the carcass after harvest. The measurements between the live animal and carcass traits were then correlated and the means and standard deviations were both evaluated for all traits. In addition, ten sheep in 2021 were evaluated. The same data were included in the analysis as well as the correlation of composition traits between the live animal ultrasounds and their carcass. The values for the ultrasound are concluded to be strongly correlated to the ones on the carcass for the rib eye area as well as for loin depth. This research also shows that the left and right sides of the rib eye are strongly correlated but not exactly the same. Our findings indicate that these specific composition traits all strongly correlate with the live animal ultrasounds and their carcass, thus allowing producers to use this information in order to select for offspring with good body composition traits from the live sheep that show to have good composition traits in their ultrasounds; in turn, the producer will then be able to gain more profit and an overall higher gross income with this information.

184

Name: Green, Claire

Major: Biochemistry

Faculty Advisor: Priyadarshini Chakrabarti Basu, Biochemistry, Molecular Biology, Entomology, and Plant Pathology

Co-Author(s): Pierre Lau

Creating a phenology wheel for the Southeast region

Beekeepers often choose the habitat for bees without an understanding of the nutritional quality of nearby plant pollens. Better understanding of floral resources would aid researchers as they aim to strengthen bee populations, which are critical for agricultural production worldwide. The objective of this project is to create a database of pollen samples collected throughout the state of Mississippi that beekeepers and researchers can use to improve their knowledge of bee habitats. The database will show the phenology of numerous plant species. The project involves working with citizen scientists to obtain pollen samples. In processing the samples, we rely on color sorting and acetolysis. The long term goal of the project is for the Mississippi data to be part of a larger database of pollen nutritional composition. The availability of that data will increase understanding of the phytosterol requirements of bees and allow farmers and conservationists to make better informed decisions when designing habitats aimed to optimize bee health.

185

Name: Green, Zeb

Major: Ag Eng Tech & Bus

Faculty Advisor: Mary Love Tagert, Agricultural & Biological Engineering

Co-Author(s): Paz O. Joel and Tsz H. Lo

Funding: ORED Undergraduate Research Program, MS Soybean Promotion Board

Low-Cost Precision Agriculture Solutions for Advancing Irrigation Efficiency

Only 30% of Mississippi's average annual precipitation is received during the growing season. Accordingly, an increasing number of on farm water storage (OFWS) systems have been built in Northeast Mississippi in recent years. Farmers solely dependent on surface water have a finite amount of water to use for irrigation through the growing season and must irrigate efficiently. Using sector control variable rate irrigation (VRI) may help farmers improve irrigation efficiency and productivity. The main objectives of this project are to 1) evaluate the potential water-saving benefits of sector control VRI on a production field and 2) perform a geospatial inventory of OFWS irrigation systems to assess the potential adoption of VRI in Northeast Mississippi. The study area is an 18-hectare corn and soybean production field under sprinkler irrigation in Noxubee County, where two irrigation management zones were implemented in the field. A 'dry' irrigation management zone was placed in the southern section of the field, and a 'wet' irrigation management zone was placed in the northwestern section of the field. Each management zone is approximately one quarter of the area under the center pivot and was subdivided into six pie-shaped sectors, where three control sectors received 1.9 cm of water, which was the conventional amount of irrigation applied by the farmer, and three test sectors received 1.5 cm of water, which was a 20% reduction from the conventional amount. National Agriculture Imagery Program (NAIP) imagery from 2020 is being used for the inventory to identify OFWS systems or center pivots, which are marked as a single point at the pivot point. OFWS systems are digitized into polygon shapefiles using the water level of the pond at the time of image collection as the boundary. Currently, 12 of 22 counties have been completed. Preliminary results for both objectives will be presented.

186

Name: Guilliams, Piper

Major: Biomedical Engineering

Faculty Advisor: Sungkwang Mun, Center for Advanced Vehicular Systems

Funding: ORED Undergraduate Research Program

Design Analysis of Antibacterial Nanotextured Surfaces using Machine-learning Techniques

In this research, the geometrical parameters of antibacterial nanotextures, such as diameter, height, and spacing, were analyzed and optimized using artificial neural networks (ANN) techniques regarding each bacterial strain and substrate material in order to provide the most effective parameters for antibacterial nanotexture. Antibacterial nanotexture refers to the surface structure that causes destruction or repellence of bacterial cells by the contact material's surface characteristics. This research can contribute to a problem associated with antibiotic resistance and biofilm formation, with an intention to implement nanotextures on implantable devices. This project was composed of two parts: first, 200 data were collected from prior research on manufactured (titanium, stainless steel, and polymer) and natural (insect wings, plant leaves, and reptile skin) antibacterial surfaces. This data includes the bacterial strains, the material of the substrate or species of the natural substance, the diameter, height, and spacing of the nanotexture, and the antibacterial effectiveness percentage. Then, with these parameters, the ANN optimized the nanotexture on the surface of a material to have the highest antibacterial effectiveness possible based on the data provided. This is possible because the ANN is flexible and highly predictive due to its multi-layer structures with many computational nodes or "neurons" within each hidden layer. The ANN model that gives the most accurate predictions will be selected by evaluating different shapes or sizes of networks along with other hyperparameter tuning processes. Once the training process is complete, the trained ANN model will be used in an optimization process to search for the most effective design parameters related to antimicrobial effectiveness. The outcome of this study will provide the basis for predicting the parameters for making and modifying nanotextured surfaces by machine learning techniques and will help design antibacterial biomedical devices inserted into the human body, such as orthopedic replacements and dental implants.

187

Name: Guo-Yue, April

Major: Biomedical Engineering

Faculty Advisor: Lauren Priddy, Agricultural and Biological Engineering

Co-Author(s): Alexis Graham, Umamah Amer, Charlotte Thompson, Darrock Flynn, Sophie Jones, Matthew Priddy

Validating Osteogenic Differentiation of Bone Marrow-Derived Cells in 2D Culture for Use in a Custom 3D Bioreactor System

The development of customized *in vitro* systems for studying bone formation could improve orthopedic implant testing by creating more controllable, repeatable, and cost-effective methods to study osteogenesis. In particular, 3D bioreactor systems provide a controlled environment that mimics *in vivo* conditions for bone formation. Initially, a 2D *in vitro* system is needed to validate that

primary cells will differentiate into osteoblasts, before scaling up to 3D systems. Our objective was to validate the osteogenic differentiation of porcine primary bone marrow-derived stromal cells (pMSCs) in 2D static culture and in a custom perfusion-compression 3D bioreactor system. The 3D bioreactor comprises six polycarbonate chambers which are fitted in two compressive loading frames (3 in each) and connected to a peristaltic pump with silicone tubing for media perfusion. Osteogenic differentiation in 2D culture was validated by seeding pMSCs into 24-well plates and performing alkaline phosphatase (ALP) assays on days 14, 21, and 28 and alizarin red staining on days 21 and 28. ALP is an early marker of osteogenesis and is involved in mineralization of bone cells. ALP activity increased over time and peaked at day 21, indicating the pMSCs were differentiating into osteoblasts. Alizarin red staining was used to indicate late osteogenic differentiation by staining calcium mineralization. In the 3D system, pMSC cells were perfusion-seeded into each bioreactor chamber on porous trabecular bone explants extracted from pig femurs. Currently, the effects of perfusion flow alone and combined perfusion and compression conditions in the 3D bioreactor system are being compared to determine cell seeding efficacy for enhanced osteogenesis. The validation of primary bone marrow-derived cells' capacity to differentiate into osteoblasts in a 2D culture system before testing on a custom 3D in vitro system holds significant potential for developing more effective and personalized methods to test treatments for bone injuries and diseases.

16

Name: Gupta, Surabhi

Major: Wildlife, Fisheries & Aquaculture

Faculty Advisor: Adam Skarke, Geosciences

Funding: Shackouls Honors College Research Fellowship

Identification of Seafloor Gas Seeps in Sonar Data to Develop a Machine Learning Detection Database

Seafloor gas seeps, which discharge methane gas into the ocean, are found on continental margins globally. They are an important component of the global marine biogeochemical cycle but their quantity and distribution are not well understood. Notably, seeps contribute to ocean acidification and deoxygenation. Additionally, they are biodiversity hotspots for benthic ecosystems, a demonstrated energy production resource, and a potential marine geohazard. Hence, it is important to identify these seeps but the current method used to discover them is manual visual detection of seep bubble plumes in sonar data by trained individuals, which is costly and time consuming. Here we develop a database of identified seeps to train machine learning algorithms to automatically detect gas seeps in sonar data. We developed MATLAB code to process and display multibeam sonar fan beam water column imagery as well as to label rectangular portions of the images containing seep plumes. So far, we have labeled and classified the presence or absence of seeps in over 160,000 sonar images. Additionally, we have collaborated with computer engineering colleagues to develop a machine learning framework for seep identification from the identified and labelled seep database. Machine learning algorithms enabled by this database will create a broadly applicable ocean exploration technology that will increase the efficiency and accuracy of seep discovery while also decreasing cost and personnel requirements. Furthermore, it will improve our understanding of these dynamic ocean features and subsequently, associated seafloor environmental and ecological processes.

188

Name: Haley, Caroline

Major: Biomedical Engineering

Faculty Advisor: David Van den Heever, Agricultural and Biological Engineering

Monitoring Brain Activity During Table Tennis

The phrase "practice makes perfect" persists in the minds of those who partake in an organized activity. This especially holds true in athletics, for athletes dedicate their minds and bodies to their sport of interest. An increased amount of training allows for additional opportunities for repetition, which will alter an athlete's brain activity over time. To determine the degree of this alteration, an electroencephalogram (EEG) is required. Each electrode channel of an EEG targets a different area of the brain and transmits any electrical fluctuations (brainwaves) present into visual data. The primary brainwaves of interest in this experiment are the alpha and beta waves. Alpha waves range from 8-12 Hz, which signify being awake and alert. Beta waves range from 13-30 Hz, which signify frustration and stress. In any sport alertness and frustration are inevitable, which makes alpha and beta power appealing to researchers. The intention of the experiment is to analyze the participant's brain activity while they play table tennis. The player is given 10 practice serves and returns before 100 recorded serves and returns. The accuracy of the participant is observed along with their recorded brain activity. The participant "wins" if they make their serve or return within the boundaries marked on the table, and "loses" if they hit the ball outside of the boundaries. The number of "wins" and "losses" and the brainwave frequency of the participant at each incident are applied to determine a potential correlation. The correlation can be utilized to locate the optimal mental state for an athlete that will produce the most success. Twelve participants have been observed, with six being experts and six being amateurs. Experience level is considered since repetition can alter a person's brain activity and all levels of athletes can be accounted for.

17

Name: Hammons, Leah

Major: Biochemistry

Faculty Advisor: Jing Hu, Geosystems Research Institute

Co-Author(s): Zihan Li, Dana M. Miles, Frances A. Podrebarac, and Jing Hu

Funding: ORED Undergraduate Research Program

Effects of Cover Crops on Soil Temperature, Moisture, and Carbon Dioxide Emissions

Almost 10 percent of the greenhouse gas emissions responsible for climate change in the United States is linked to agriculture. Cover crops have proposed a solution to this modern problem by being able to sequester carbon and mitigate greenhouse gas emissions, including carbon dioxide and nitrous oxide, from agricultural soils. The adoption of cover crops in the southeast of the USA has been low, due to limited region-specific research and resistance to unproven practices. A field study was conducted in a corn cropping system located in the North Farm. The research field had 2 tons of broiler litter applied on September 19, 2022, and the cover crop was planted on September 20, 2022. The cover crops were planted in an alternating system of no cover crop, Austrian Winter Field Peas, Elbon Rye, and a mix of the Peas, Rye, and Daikon Radish. The measurements of carbon dioxide, soil temperature, and soil moisture were collected using LI-COR CO₂ analyzer once every week. Weather confusions sometimes prevented weekly emission measurements. The results reveal that during colder temperatures (9-23°C), Elbon Rye had the lowest soil carbon dioxide emissions. Austrian Winter Field Peas measured the highest soil moisture overall while no cover crops had the lowest soil moisture. This leads to the conclusion that out of the cover crop treatments, Peas showed the most effective for capturing moisture, and Rye measured the best for carbon dioxide emissions.

46

Name: Harjono, Trisha

Major: Art

Faculty Advisor: Cassie Hester, Art

Funding: CAAD Creative/Research Experience for Undergraduates

Forming a Contemporary Identity with Traditional Techniques: Identity Exploration through Digital and Tactile Processes of Screen Printing and Batik

"Third culture kid" (TCK) is a term that is used to describe individuals who grew up in different cultures, and as a result, often develop unique, blended cultural identities. I am a TCK because I was born and raised in Indonesia, but I am ethnically Chinese and educated by the US education system. As a design student, I am processing my unique identity and third culture through the exploration and synthesis of diverse cultural and artistic traditions. By using Chinese calligraphy and fiber arts processes like batik dyeing, this qualitative study will be an exploration of surface and textile design, highlighting the interaction between digital and tactile processes of screen printing and batik. Through this study, I plan to learn and connect with the cultural materials and methods, synthesize these different methods into textile pieces, and investigate language through calligraphic explorations in Chinese characters and Indonesian batik pattern designs that are native to the island of Java. In each of the explorations, the fabric will have batik patterns that are hand drawn using "tjantings" (pen-like tool to apply wax) and dyed with acid dyes. I will create a design of my Chinese name by hand and digitize it for transparency printing which allows it to be screen printed on top of the batik fabric. By using this meticulous approach between digital and tactile processes, I will be able to blend different cultural elements together and create art pieces that are representative of my contemporary identity as a TCK.

189

Name: Harlow, Maya

Major: Animal and Dairy Science

Faculty Advisor: Priyadarshini Chakrabarti Basu, Biochemistry, Molecular Biology, Entomology, and Plant Pathology

Funding: College of Agriculture and Life Sciences URSP

Understanding the Nutritional Composition of Bee-Collected Pollen

Honey bees (*Apis mellifera* L.) are critical pollinators globally. In addition to their contribution to the global economy through pollination services, they are shown to pollinate over 75 percent of all flowering plants including food crops. Poor nutrition, along with pesticides, Varroa mites and other stressors, have contributed to the recent drastic decline in global honey bee populations. Native bees are also facing similar threats. Pollen serves as a vital component of bee nutrition, providing macro and micro nutrients such as amino acids, lipids, vitamins, salts, phyosterols and essential minerals. The purpose of this current study is to further investigate the nutritional value of various types of pollen. Different biochemical assays are used to evaluate the protein and lipid concentrations of bee-collected pollen samples. The ultimate goal of this project is to develop a nutritional database available to the public that will be used to scientifically inform beekeepers, growers, researchers, policy makers and the general community about the types of flowers to plant to build a pollinator habitat that will best nutritionally sustain all bee species.

58

Name: Harpole, Garrett

Major: Landscape Architecture

Faculty Advisor: SaMin Han, Assistant Professor

Funding: College of Agriculture and Life Sciences URSP

Urban Park Usage During The COVID-19 Pandemic

Historically, urban public spaces have played essential roles in environmental purification, social gathering, public health, etc. However, COVID-19, the global pandemic, affected the urban lifestyle and the usage of public parks. Many traditionally successful places are called into question for their effectiveness in providing needed areas for these traditional programs under pandemic-related circumstances. In this regard, this study discovered how the use of public places has changed before and after the pandemic, with a focus on the local parks in the Golden Triangle Region – Starkville, West Point, and Columbus in Mississippi. Beginning with the literature review on urban parks and COVID-19, this study was approved by the IRB Board (Project: IRB-23-003) to conduct human subject research and used an online survey and in-person interviews in the local parks as research methods. With the answers of 67 respondents (63 survey participants and 4 Interviewees, effective on March 21, 2023), the study will determine if there is a relationship between remote work and the duration of time spent at local parks. Additionally, this study will determine if there is a relationship between the presence of household members under 18 years of age and park usage. It will determine any association between the presence of household members under the age of 18 and increased park usage during the COVID-19 pandemic. Finally, usage and duration patterns will be compared to survey responses about park usage behaviors after the COVID-19 pandemic to determine if there is a change in park usage or if it has reverted to original usage patterns. These findings aim to determine a positive correlation between work-from-home and park usage and duration. If so, these results justify that a hybrid work environment is better for social connectivity, family structures, and mental health.

190

Name: Hatten, Sally

Major: Kinesiology

Faculty Advisor: Adam Knight, Kinesiology

Co-Author(s): Harish Chander, Aaron Griffith, Jacob Hull

Characterizing Neuromuscular Effort in Primary Ankle Stabilizers in Soccer Players When Performing a Dynamic Balance Test.

It has been estimated that ankle sprains comprise 30% of all soccer injuries, which can lead to chronic ankle instability (CAI). Current research investigating the neuromuscular effort of the tibialis anterior (TA) and medial gastrocnemius (MG) as predictors for CAI is limited. The purpose of this research was to determine the impact of neuromuscular effort of two lower extremity muscles on the risk for the development of CAI. A sample (n=23) of female National Collegiate Athletic Association (NCAA) soccer players performed a dynamic balance test while electromyographic (EMG) readings were taken of the TA and MG. The Y-Balance Test (YBT) measured balance, and EMG readings were normalized against the player's maximum voluntary isometric contraction (MVIC). This process quantified neuromuscular effort during each task. In addition, composite scores were determined from the YBT based on the reach distances collected in three directions. Composite scores were compared against the mean percentages of neuromuscular effort to determine the risk for developing CAI. An independent T-test showed a difference of composite scores between both legs. A paired samples T-test was run on the mean percentages for each muscle and each leg in the three reach directions. A significant difference was seen in the reach distances performed between both legs during the YBT ($p < .001$). When comparing between and within muscle groups, significance was seen only in the posteromedial direction (TA: $p = .028$; MG: $p < .001$). Overall, the risk for developing CAI was minimal in female soccer athletes based upon the data analyzed. However, significantly higher muscle effort was required to stabilize the ankle in the posteromedial direction. Based upon the data reported, these athletes have a low risk for developing CAI due to the muscle efficiency of both muscles, but the athletes could work on improving neuromuscular efficiency in the posteromedial direction.

191

Name: Hawk, Landon

Major: Biochemistry

Faculty Advisor: Jovonn Hill, Biochemistry, Molecular Biology, Entomology and Plant Pathology

Funding: College of Agriculture and Life Sciences URSP

Systematic Map of Herbivores on Carnivorous Plants

Carnivorous plants are a group of plants that are capable of capturing and digesting insects, however, there are several arthropods that herbivorize carnivorous plants. What morphological or behavioral traits have these insects accrued to eat CPs, and is there a common strategy among the insects to overcome the plants offensive traits? We are synthesizing evidence concerning arthropods on carnivorous plants to find common patterns. Evidence synthesis uses a framework of search, screen, and code to generate a database that we can use to answer a research question. We published our protocol with PROCEED, a peer-reviewed registry for evidence

synthesis, and completed searching research databases for evidence. Currently, we are screening literature using inclusion criteria based on our research question. We anticipate completing our map late this fall.

192

Name: Headley, McCaa

Major: Biochemistry

Faculty Advisor: Richard Baird, Biochemistry, Molecular Biology, Entomology, and Plant Pathology

Co-Author(s): Hannah Easley

Developing Methodologies for Soybean Extraction Using NMR

The soybean (*Glycine max* (L.) Merr.) is a subtropical plant native to southeastern Asia. However, the climates of many regions in which soybeans are grown have already begun to change drastically, including high temperature and periodic drought, thus increasing susceptibility to disease and causing crop loss. Methods to evaluate cultivar tolerance to these environmental changes becomes critical for future molecular breeding targets. Nuclear magnetic resonance (NMR) is a safe and cost-effective method for evaluating the small molecular weight metabolic components. In the case of soybeans, metabolites can be used for early disease detection and evaluation of cellular health. Metabolomic analysis grants insight into the pathways within an organism that maintain homeostasis including the oxidant/antioxidant ratios metabolic intermediates or other targeted biochemicals. The variation of key metabolites associated with upstream or downstream intermediates allows for the assessment of the impact different environmental factors have on the phenotypic or epigenetic states of soybeans. To assess the metabolome, extraction of metabolites is necessary but optimization of the extraction process for the NMR platform is a crucial first step. This study describes the methodology development necessary to optimize metabolomic spectral data collection using NMR. Four metabolite extraction protocols were assessed for their extraction efficacy as evaluated by the quantity of metabolites extracted in each protocol. Additionally, to account for the presence of large proteins within the sample causing interference, each protocol's extractant was subjected to filtration. Finally, given that several of the published protocols required lyophilization as they were initially created for analysis on mass spectrometry platforms, trials to determine the ideal drying temperature were conducted. All these data are presented along with statistical analysis.

97

Name: Henry, Summer

Major: Fashion Design & Merchandising

Faculty Advisor: Tommy Phillips, Human Development and Family Science

Co-Author(s): Lydia Asters, Destinee Bafford, Taiyler Cobb, Sophie Nolan

The Influence of Strict Dress Codes on Recollected Self-Esteem and Body Image

In recent years, strict dress codes and methods of enforcement have faced scrutiny. While these dress codes were originally implemented to promote safety and learning in response to gang violence and prurient clothing, recent studies have brought to light the racist and sexist undertones of strict dress code policies (Carey, n.d.; United States Government Accountability Office, 2022). However, there is a gap in knowledge related to how these policies directly impact students, such as their self-esteem and body image. The purpose of this study was to examine the influence of strict dress codes on college students' recollected self-esteem and body image in their high school years as well as the roles that gender and ethnicity play in the relationship. We hypothesized that strict dress codes would be negatively related to recollected self-esteem and body image. We also hypothesized that the relationship between strict dress codes and recollected self-esteem and body image would be moderated by gender and ethnicity. To test these hypotheses, an online survey was used to collect data. Using SPSS 28.0, correlation analysis was conducted to assess the relationship between strict dress codes and recollected self-esteem and body image. Tests of between-groups differences were conducted to explore the potential moderating roles of gender and ethnicity in the relationship between strict dress codes and recollected self-esteem and body image.

18

Name: Hensley, Clark

Major: Computer Science

Faculty Advisor: Matthew Priddy, Mechanical Engineering

Co-Author(s): Logan Betts, CJ Nguyen, Matthew W. Priddy

Funding: Center for Advanced Vehicular Systems

ODBPlotter: An Open Source Data Processing and Visualization Tool for Wire Arc Directed Energy Deposition

Wire arc directed energy deposition (WA-DED) is a metal-based additive manufacturing process that produces a component in a layer-wise fashion as defined in a Computer Automated Design geometry. Tools for finite element analysis simulate the heat transfer through the deposition process, such as Abaqus finite element software. However, Abaqus uses Python 2 scripting to analyze the data generated by the finite element solver. This means that engineers working with Abaqus must either interface with Python 2, which is no longer

supported and considered insecure to use, or must manually run their simulations in Abaqus. In the past, there have been tools aimed at improving this shortcoming by ensuring that Abaqus Python 2 is written to the same standard as modern Python 3 code or writing more intuitive Python 2 interfaces. This work has developed an open-source program, named ODBPlotter, to interface directly with Abaqus' object database (.odb) file format, allowing for Python 3 scripting, post-processing, and visualization of data generated with Abaqus. ODBPlotter implements modern data storage via the .hdf5 file format and 3-dimensional plotting techniques to improve efficiency and reliability when interfacing with the .odb format. ODBPlotter's modern interface allows for its users to efficiently extract data from .odb files and store that data in a portable, cross-platform .hdf5 format which can be used in many environments and shared with collaborators.

98

Name: Hensley, Marilee

Major: Food Science, Nutrition, & Health Promotion

Faculty Advisor: Rahel Mathews, Food Science, Nutrition, and Health Promotion

Co-Author(s): Bennett Pope

Funding: College of Agriculture and Life Sciences URSP

Food Insecurity, Mental Health, and Reports of Food Disruption Among Mississippi Parents During Early COVID-19

During the COVID-19 pandemic, the shipment of manufactured goods, food distributing services, and grocery store operating hours decreased. The limitation or uncertain access to nutritious foods, also known as food insecurity, is known to impact low-income communities and is linked to chronic diseases like hypertension and diabetes. The purpose of this study was to describe the food insecurity and worries of food disruption among parents living on the Mississippi Gulf Coast during the first year of the COVID-19 pandemic. Parents had to be at least 18 years old with a child enrolled in a local Head Start Program to participate. Survey items were based on food insecurity status, food disruption worries, weight, and chronic disease before and since the first year of the pandemic. Surveys were distributed to parents through Qualtrics and paper. A total of 76 surveys were analyzed using SPSS software. The majority of participants were non-Hispanic black (48.7%, N=76), female (94.7%), and under the age of 40 (82.9%). Before March 2020, very low food security was reported at 34.2% (N=76). Since March 2020, 39.5% (N=76) of participants reported having very low food security. Roughly 60.5%, 49.9%, and 68.4% (N=76) showed worry towards grocery stores closing, running out of food, and running out of water, respectively. Around 72% (N=68) of participants were overweight or obese. Approximately 25.0% (N=76) and 18.4% reported diagnoses of anxiety and depression, respectively. Results indicate an increase in food insecurity, worries of grocery store closures, and water shortages since March 2020. Though this population was eligible for SNAP and WIC, a large percent was worried about the food insecurity and access to food and water. Further investigation is needed to reduce food insecurity and food disruptions to vulnerable populations.

59

Name: Hernandez, Arturo

Major: Architecture

Faculty Advisor: Silvina Lopez Barrera, School of Architecture

Architecture Responses to Climate Change in Mexico

Worldwide infrastructures today account for nearly 40 percent of carbon emissions and architecture is the first area that needs to contribute to efforts addressing climate change including responses to drought, sea level rise, and heat islands. Countries around the world face climate challenges that need to be addressed locally. This study will focus on Mexico's climate challenges and architectural/urban design responses. Existing architectural research suggests design initiatives for the Mexican states of San Luis Potosi, Mexico City, Cancun, and Playa del Carmen are successfully mitigating climate change stresses at the urban scale. However, there is a knowledge gap on how these design initiatives at the building scale are mitigating climate challenges. From an architectural perspective, filling the research gap will enable the incorporation of various design ideas that will reduce climate change at the building scale. This research will explore how sustainable design strategies are being used in architecture and how the LEEDs evaluation system for green certification may increase the legitimacy of these climate adaptive design initiatives. Using case studies in different regions in Mexico, this research assesses the implementation of resilient and sustainable design strategies including the use of building recycled materials, passive cooling techniques for heat islands, green roofs and the use of vegetation to deflect direct sun radiation, and the use of floodproofing techniques responding to sea level rise. These architectural design approaches can be applied not only in Mexico but also in other countries around the world facing similar climate-related challenges. Finally, this study will provide a critical perspective on buildings and structures that are constructed in regions with problematic climates encouraging researchers and practitioners to address sustainability and resiliency in architecture to stand against the urgent and future climate.

99

Name: Herndon, Mikayla

Major: Psychology

Faculty Advisor: Hilary L. DeShong, Psychology

Co-Author(s): Addison All, Kren Kelley

Five Factor Model personality traits subsume the impact of grit on depression, anxiety, and stress

Grit is considered a unique predictor of life outcomes and is generally framed as a positive trait for people to possess. However, there are concerns surrounding whether grit is a unique personality construct or if grit is subsumed within a general model of personality, such as the Five Factor Model (FFM). Like FFM personality traits, grit contributes to both adaptive and maladaptive outcomes. For example, some research suggests higher grit is positively associated with a person's perceived ability to die by suicide and more frequent suicide attempts with lethal intent compared to those lower in grit. Relative to research on adaptive outcomes, research assessing grit in relation to maladaptive outcomes is limited. This study advances previous research by assessing the incremental validity of grit as a contributor to depression, anxiety, and stress relative to FFM traits. Consistent with the current literature, it was predicted that grit will account for no additional variance beyond the FFM traits. Data analyses were completed on two separate preexisting data sets – one sample collected from MSU college students ($N = 497$) and one from Amazon's Mechanical Turk (MTurk; $N = 434$). Participants completed a remote Qualtrics survey including measures of FFM personality traits, grit, depression, anxiety, and stress. Across both samples, grit did not provide any incremental validity beyond the FFM traits for all three outcomes. These results suggest that grit may be subsumed within a general model of personality. Future research would benefit from comparing the predictive capabilities of grit and the FFM on other negative life outcomes, such as suicidality and non-suicidal self-injury.

19

Name: Heson, David

Major: Physics

Faculty Advisor: Matthew Peuple, Shackouls Honors College

The Domestic Experience of Italian Women in the Anti-Fascist Resistance During 1943-1945

Under most European fascist regimes, domestic resistance served as an important roadblock to these dictatorships, preventing complete societal submission and aiding in the liberation of these territories. Particularly, in Italy the anti-fascist resistance and its partisans played an essential role during the Civil War, disrupting fascist supply lines, serving as messengers, and generally weakening the Axis forces while building up the community which would eventually rebuild Italy in the aftermath of the war. This work focuses in particular on the diaries of two women who took part in the resistance efforts. One of these is Ada Gobetti, who was a mother and partisan based out of Turin, who helped organize various partisan movements across the Piedmontese valley. The second woman is Iris Origo, who was born in England but moved to and married an Italian man in Southern Tuscany. Her farming community was caught in the cross-fire of the Allied and Axis forces, and often served as a shelter for escaped Allied POWs and Italian partisans.

47

Name: Heson, David

Major: Physics

Faculty Advisor: Angelle Tanner, Physics & Astronomy

Creating a Pipeline to Process Keck Observatory NIRC2 DQ Tau Star Binary Visual Data

The purpose of this project is to create a pipeline in Python 3 which can be used to perform the necessary processing on image data collected from the Keck Observatory NIRC2 Instrument. The NIRC2 is a near-infrared imager which operates in tandem with the observatory's adaptive-optics apparatus. Currently, the codebase is in its early stages of development, with the goal of creating a user-friendly Python package which can process data from any NIRC2 observation. DQ Tau was chosen as the test target for the development of the codebase due to the large number of observations of this star binary.

20

Name: Higginbotham, Oliver

School: Mississippi School for Math and Science

Faculty Advisor: Vuk Marojevic, Electrical and Computer Engineering

Funding: AERPAW

Enhancing 5G Communication Research Testbed Experience with Proxmox Hypervisor

One of the significant challenges in computational research, particularly in computer science, is the limitation of hardware resources that are typically shared among multiple team members. To address this issue, this research aims to enhance the testbed experience for 5G

communication research through the implementation of a Proxmox hypervisor. The testbed system needed in AERPAW uses Kubernetes, Docker, and Helm to run 0-RAN with multiple xApps for cellular communication, requiring significant hardware resources. This research focuses on improving the efficiency of resource allocation among multiple research students running computationally intensive workloads. The proposed system aims to provide the same resource requirements to ten to twenty students who will remote into their respective Virtual Machines (VMs) on the same hardware previously used by only one student. The previous system utilized Ubuntu 20.04 installed with 20 CPU cores and 128 GB of memory, while the implementation of Proxmox will have ten individual VMs running the same Ubuntu 20.04 with 4 cores and 8 GB of memory each. To test the efficiency of this system, we ran a series of experiments, comparing the performance of the previous system to the proposed Proxmox implementation. Our experiments demonstrated that the computational programs used on these testbeds only require 4–6 cores and at least 6 GB of memory. We collected and analyzed data on CPU usage, memory usage, and power consumption, and found that Proxmox not only yielded better system usage than traditional methods, but also improved the testbed sharing experience by allowing multiple students to access the system simultaneously. This research demonstrates the effectiveness of implementing a Proxmox hypervisor for computational research in 5G communication. By enabling more efficient resource allocation and improving the testbed sharing experience, this system can significantly enhance the productivity and collaboration of research teams working on computationally intensive tasks.

100

Name: Hill, Allison

Major: Psychology

Faculty Advisor: Hilary L. DeShong, Psychology

Co-Author(s): Julie Anne M. Miller, Kren Kelley

Five factor model personality domains differentially predict engagement in anger and depressive rumination.

Rumination is a form of repetitive negative thinking during which a person continuously thinks about a past negative emotion or event. Ruminative thoughts can focus on a variety of different emotional experiences, such as anger or depression. This ruminative process often leads to an increase in the intensity of a person's negative emotions. While rumination is often studied in relation to personality disorders, research has yet to examine general personality characteristics as potential underlying risk factors for engagement in rumination. The current study assessed how Five Factor Model personality domains differentially contribute to engagement in depressive and anger rumination. Participants ($N = 403$) completed an online study assessing self-reported personality traits, anger rumination, and depressive rumination. Hypotheses were tested using a multivariate regression in AMOS. The FFM domains accounted for 38.6% of the variance in depressive rumination and 35.1% of the variance in anger rumination. Heightened neuroticism and extraversion significantly predicted increased engagement in depressive and anger rumination. Openness was a unique positive predictor of depressive rumination, whereas agreeableness was a unique negative predictor of anger rumination. Conscientiousness was unassociated with either form of rumination. Overall, the current study demonstrates differential relations between the FFM domains and two types of rumination. Future research may benefit from examining general personality domains in relation to various cognitive strategies that may serve as protective factors that help diminish ruminative thought processes.

101

Name: Hilliard, Allison (Amber)

Major: Animal and Dairy Science

Faculty Advisor: Molly Nicodemus, Animal & Dairy Sciences

Co-Author(s): Molly Friend, Clay Cavinder, Katie Holtcamp, Dean Jousan

Funding: ORED Undergraduate Research Program

Does short-term equine interaction within a collegiate environment provide students with perceived coping skills for test anxiety during examination periods?

An epidemic of mental health concerns is apparent within the collegiate environment, especially during examination periods where stress and anxiety may be heightened. Studies have demonstrated equine interaction in an academic setting can improve life skills important for coping with the rigors of academics. While the benefits of consistent equine interaction have been reported, the impact of equine interaction on coping skills valuable for managing test anxiety for college students has yet to be studied. Therefore, the purpose of this study was to evaluate the impact of short-term equine interaction on perceived stress and coping skills development during the college examination period. Full-time college students ($n=27$; Males=3, Females=24) engaged in a 1-hr equine interaction session consisting of grooming, leading, and grazing that was held at the onset of final exam week (Fall 2022). Participants were given a 14-question survey pre- and post- equine interaction. Data was analyzed using a two-tailed t-test to determine the significance of self-reported measures with significance set at $P \leq 0.05$. Participants (67%) reported moderate to high levels of anxiety surrounding grades and upcoming examinations prior to equine interaction. These perceived anxiety levels were significantly reduced following equine interaction (93% reporting none to very low stress levels; $P < 0.001$). Perceived improvements were reported by participants in the following coping skills after equine interaction: focus ($P = 0.008$), self-efficacy in goal pursuit ($P = 0.006$), patience ($P = 0.017$), and calmness

($P < 0.001$). These results suggest that collegiate equine interaction programs may be of benefit to students during high stress periods within the academic year.

21

Name: Hoffmann, Luca

School: University of Mississippi High School

Faculty Advisor: Christopher R. Hudson, Center for Advanced Vehicular Systems

Funding: Center for Advanced Vehicular Systems

Deploying the NATURE Autonomy Stack to a 1/10th Scale RC Vehicle

The Center for Advanced Vehicular Systems (CAVS) Navigating All Terrains Using Robotic Exploration (NATURE) autonomy stack is an open-source stack for off-road navigation. The stack is fully integrated with the Robot Operating System (ROS), a popular software framework used to develop robotics applications. To date, the stack has only been tested on medium sized vehicles (Polaris MRZR) and scalability of this autonomy stack needs to be explored. This project integrates the NATURE autonomy stack on a 1/10th scale RC vehicle to enable study of the NATURE stack on different sized vehicles. This extension to support multiple vehicle sizes opens the door for more in-depth studies on the scalability of the NATURE stack. Furthermore, by enabling autonomy at the 1/10th scale, this project provides a cost-effective approach for a wider range of researchers to engage in autonomy research and development for real-world vehicles. As an added benefit, there is a reasonable expectation that the developed algorithms can be contributed back to the NATURE stack for use on full sized vehicles. To enable the use of the NATURE stack, we integrated an Intel Realsense L515, an Nvidia Jetson Nano, and a Aceinna OpenRTK GPS/INS unit. The combination of these sensors' data provides the information for the NATURE stack to execute autonomous behavior. This study records initial data which demonstrates the successful integration of the sensors and ensures the proper data is being generated for the NATURE stack. This successful data processing will lead to future studies conducted using the 1/10th scale RC car and the NATURE stack.

193

Name: Holland, Trevor

Major: Biochemistry

Faculty Advisor: Seung-Joon Ahn, Biochemistry, Molecular Biology, Entomology and Plant Pathology

Co-Author(s): Sujin Lee

Molecular cloning of G protein-coupled receptors for pyrokinin neuropeptides in the western flower thrips

The western flower thrips, *Frankliniella occidentalis*, is one of the most destructive insect pests for many plants in the world. Thrips can feed on a variety of host plants, causing serious damages on leaves and flowers and, thereby, yielding decreased crop productions. The western flower thrips acts as a vector of tomato spotted wilt virus (TSWV) in particular, which further damages plants with various symptoms including ringspots, necrosis, wilting, and mottling. Current control of thrips heavily relies on synthetic pesticides, but increasing demands are environmentally harmful to plants and animals alike. G-protein coupled receptors (GPCRs) are the largest class of membrane proteins and are excellent targets for future management of insects. Many GPCRs are activated by neuropeptides such as pyrokinin, that is known to trigger pheromone biosynthesis in other insects. The present research includes molecular cloning of *F. occidentalis* pyrokinin receptors which will allow for functional assay and quantitative gene expression experiments to be completed for characterization of the pyrokinin GPCRs. Identification, sequencing, and modeling of the pyrokinin GPCRs will pave a path not only for understanding the GPCR-mediated neurophysiology in thrips, but also for developing next-generation green pesticides that are more specific to thrips and environmentally friendly.

194

Name: Hood, Ariory

Major: Biomedical Engineering

Faculty Advisor: Steven Elder, Agricultural & Biological Engineering

Funding: ORED Undergraduate Research Program

Development of in situ forming PLGA implants for sustained delivery of chondroprotective punicalagin

Osteoarthritis (OA) is a type of joint disease that results from the breakdown of the cartilage that cushions the ends of bones in a joint. This can cause pain, stiffness, and swelling in the affected joint. As the cartilage wears away, the bone structure may also change, leading to bones rubbing against each other. Punicalagin is a potential disease-modifying osteoarthritis drug. Its purpose would be to inhibit the degradation of knee cartilage. Intra-articularly injected drugs are typically cleared from the joint within a few hours. This project seeks to develop an injectable system that would sustain delivery for many weeks. Our approach is a poly(lactic-co-glycolic acid), or PLGA, an implant that forms in-situ when a solution of drug and PLGA is injected into water. The goal is to develop a system with a constant rate of drug release. Implants were formed using different solvents and punicalagin as a model drug. The rate of punicalagin

release from PLGA implants was monitored over several weeks using UV/Vis spectrophotometry. We also tested the effect of adding a surfactant, sodium dodecyl sulfate (SDS), to the water. Results indicate that the drug release rate is highly sensitive to solvent type and mildly sensitive to the presence of SDS.

102

Name: Hooper, Arielle

Major: Psychology

Faculty Advisor: Ben Porter, Psychology

Examining Associations Between Mania and Poor Hygienic Practices

Symptoms of mania interfere with an individual's daily functioning. This interference may include a disruption to standard or routine hygiene practices or the individual. However, there is limited research examining the relationship between hygienic behaviors (such as washing hands, bathroom hygiene, clothing hygiene, and showering/bathing) and symptoms of mania. This study analyzed the relationship between DSM-5-TR symptoms of manic episodes and the tendency to engage in such hygienic practices. Using Qualtrics, we surveyed 239 undergraduate students for a history of symptoms consistent with a manic episode. These students completed an abbreviated hygiene survey, based on Stevenson et al.'s (2009) hygiene inventory (HI23). After cleaning data for missing results, we were left with over 200 participant responses ($n = 236$). A bivariate Pearson correlation was performed to assess a potential relationship between symptoms of mania and hygiene behaviors. Analysis was completed using SPSS. This analysis showed a statistically significant linear relationship between DSM-5-TR symptoms and hygiene behaviors ($r(234) = -.131, p = .045$). From this, we can understand that those who report experiencing more symptoms of mania are at risk for less engagement in hygiene behaviors. These findings may encourage health professionals to emphasize hygiene with patients reporting symptoms consistent with mania to improve social and physical well-being.

103

Name: Horton, Jackson

Major: Agricultural Education, Leadership, and Communications

Faculty Advisor: OP McCubbins, School of Human Sciences

Career and Technical Education Teachers' Opinions on Virtual Reality

Educational strategies have evolved significantly with the integration of technology in the classroom, enabling students to interact with information on a broader scale. The role of technology in education is fourfold, including its use in curriculum, instructional delivery systems, aiding instructions, and enhancing the learning process. Emerging technologies, such as cloud computing, mobile technology, massive open online courses (MOOCs), games and gamification, augmented reality, and virtual reality (VR), provide educators with resources to improve their teaching methods. Virtual Reality (VR) is a computer-generated virtual environment that users can navigate and manipulate in real time. VR offers students unique opportunities to gain hands-on experience with content through various programs and scenarios. The study sought to examine teachers' opinions on VR in Career and Technical Education (CTE) settings and their experiences with the technology. The Technology Acceptance Model served as the guiding framework for this study, which is based on the concepts of perceived usefulness and perceived ease of use. The study utilized a modified version of the VR Technology in School-Based Agricultural Education Settings questionnaire to examine CTE teachers' opinions on VR technology. The study found that CTE teachers have a favorable view of VR usage in the classroom, believing it would be beneficial for learning new skills and concepts, and could add a STEM focus to their CTE program. Teachers indicated that they and their students would enjoy using VR in the classroom. Additionally, teachers felt that administrators would view VR usage favorably in their programs. Understanding teachers' perceptions of virtual reality technology is crucial for ensuring its effective use in education. This study fills an important gap in the literature and has the potential to inform the implementation of VR technology in classrooms, leading to more engaging learning experiences for students.

104

Name: Howard, Deja

Major: Psychology

Faculty Advisor: Mary Read-Wahidi, Social Science Research Center

Co-Author(s): Ragsdale, K.

Funding: USAID Award No. 7200AA18CA0003

USAID Feed the Future Innovation Lab for Fish

Introduction: Gender Responsive Agricultural Development (GRAD) recognizes the importance of considering both men's and women's roles, responsibilities, and priorities to effect sustainable change and improve productivity among smallscale farmers, aquaculturists, and fishers/gleaners. This is even more important as smallscale farmers, aquaculturists, and fishers will be at the vanguard of feeding a

global population of 9.8 billion by 2050. Indeed, as USAID (2019) reports, “by providing women farmers with the same access to land, new technologies, and capital that men have, we could increase crop yields by as much as 30 percent.” **Methods:** To evaluate and monitor the Feed the Future Innovation Lab for Fish’s (FIL) implementation of GRAD activities, the Gender Impacts Lab administered the Gender Responsive Aquaculture/Fisheries Development Assessment (GRADA-FIL) in December 2022 to all Year 2 FIL-funded research teams (N=75). The GRADA-FIL provides a snapshot of how gender is integrated into projects. **Results:** Research teams reported the following GRAD successes: 53.5% of respondents reported successfully recruiting women university students to join their research teams; 50.7% reported increasing women’s participation in aquaculture/fisheries activities to be more on par with men; and 46.7% reported consistently collecting gender-disaggregated data on the number of men and women who participated in project-related activities, such as trainings and interventions. Research teams reported the following GRAD challenges: 44% reported challenges pinpointing leverage points to boost women’s production and/or income; 34.7% reported challenges determining which gender issues to highlight when reporting results and making policy recommendation; and 34.7% reported challenges keeping consistent records of the number of men and women who participated in project activities. **Discussion:** The GRADA-FIL results will inform recommendations focused on increasing sustainable agricultural impacts to intensify agricultural productivity, which in turn, will improve economic outcomes that positively impact lives and helps lift individuals and communities out of poverty.

22

Name: Hyland, Hannah

Major: Geoscience

Faculty Advisor: Todd E. Mlsna, Chemistry

Co-Author(s): Beatrice Arwenyo, Jac J. Varco, Prashan M. Rodrigo

Rice Husk Biochar Enriched with Plant Nutrients Improves Water-use Efficiency in Acidic Soil

One of the primary issues limiting global agricultural production is water stress. In order to decrease water stress, otherwise known as water scarcity, a means of improving the efficiency of water use in plants should be explored. The dry matter of rice shoots contain upwards to 10% silicon. It is known that the application of silicon into the soil can reduce transpiration from some plant leaves. With this in mind, rice husk biochar rich in silicon could be used as an effective tool in agriculture. This study compared water use efficiency by corn plants in a sandy soil. Eight different treatments were used in the study: 1) control (no changes were made), 2) triple superphosphate fertilizer (TSP), 3) only rice husk biochar (BC), 4) rice husk treated with MgSO₄ and KCl (BCF1), 5) BCF1 treated with (NH₄)₂HPO₄ (BCF2), 6) Rice husk treated with MgKPO₄•6H₂O and MgNH₄PO₄•6H₂O (BCF3), 7) Silicon fertilizer (SiF), and 8) silicon fertilizer plus triple superphosphate fertilizer (SiF + TSP). Except for the control and silicon fertilizer treatments, equal loads of P equal to 29.7 kg P ha⁻¹ was added to each individual pot. Both P and Si uptakes followed the order: BCF2 > BCF3 > SiF + TSP > TSP > BC > BCF1 > SiF > control, suggesting peak nutrient availability from phosphorus-treated rice husk biochar compared to other methods. Water use efficiency and above ground dry weight yield positively correlated to P and Si uptakes. These experiments demonstrate that silicon fertilization enhances P availability, which in turn improves plant growth and water use efficiency.

105

Name: Hynes, Julianna

Major: Educational Psychology

Faculty Advisor: Jianling Xie, Counseling, Educational Psychology, and Foundations

Co-Author(s): Isabella Montecillo, Kristieona Epting, Kasia Gallo, and Zhuqing Lin

Stability and Change in Achievement Goals during COVID-19: Protective Factors Contributing to Motivational Resilience in College Students

Motivation is the process by which goal-directed behavior is initiated, energized, and sustained. Achievement goals endorsed by students are important constructs in educational motivation research. Some students strive to master the material (mastery-approach), or to not fail to learn or forget the material (mastery-avoidance). Others worry about performing better than other students (performance-approach), or not performing worse than others (performance-avoidance). Past research suggests that students’ achievement goal endorsement is stable over time. However, that could have changed during the emergency distance learning period due to the outbreak of Covid-19. To investigate this, data were collected from a sample of undergraduate students in China ($n = 300$) representing various majors and academic classifications. A 2x2 achievement goal framework comprising mastery-approach, mastery-avoidance, performance-approach, and performance-avoidance goals was compared *before* and *during* emergency distance education. Our study results revealed that only scores on *performance-approach* goals decreased significantly across the two learning conditions, ($t = 11.66, p < .001$). This suggests students were less likely to focus on demonstrating competence relative to others during emergency distance education. However, individual differences were detected between high-achievers and low-achievers in terms of performance-approach goal endorsement during emergency distance education. More importantly, scores on *mastery-approach* goals did not significantly decrease ($t = 1.75, p = .08$), suggesting students’ intrinsic motivation (inner desire/motivation) maintained during emergency distance education. Technology support did not positively predict *mastery-approach* goal endorsement during emergency

distance education, however student-perceived teacher support and physical learning environment were two significant predictors, implying the importance of human connection in online learning during COVID-19.

195

Name: Jessup, Ainsley

Major: Food Science, Nutrition, & Health Promotion

Faculty Advisor: Shecoya White, Food Science, Nutrition, and Health Promotion

Funding: College of Agriculture and Life Sciences URSP

Efficacy of Thermal Inactivation of Salmonella spp. in Air Fried Brownies

Air frying food products have become a recent trend that is taking over the food industry. With air fryers being a relatively newer technology, the risk of thermally inactivating pathogens present in food is still relatively unknown. In this study, thermal inactivation of brownies inoculated with a 3-strain cocktail of Salmonella Enterica, Montevideo, and Typhimurium was evaluated. The brownie batter (~800 total grams) consisted of: 150 g of all-purpose flour, 305 g of sugar, 80 g of cocoa powder, 1 g of salt, 35 g of powdered sugar, 15 g of water, 100 g of vegetable oil, 150 g of whole eggs, and 10 g of vanilla extract. The brownie batter was inoculated with 8 mL of 10 Log CFU/mL inoculum of the three-strain cocktail of Salmonella (*S. Enterica*, *S. Montevideo*, *S. Typhimurium*). The batter was placed in an aluminum tray and cooked in the air fryer for 20 minutes at 350 °F and sampled intermittently. Ten-gram samples were collected in triplicate at the following sampling times: 0-, 5-, 10-, and 20- minutes, and then placed into sterile bags with buffer. The samples were stomached for one minute to release any microorganisms present. Serial dilutions were performed and plated on Salmonella selective media, Xylose Lysine Deoxylate. The bacteria levels significantly decreased over time: 5 minutes- ~1 Log CFU/g, 10 minutes- ~4 Log CFU/g, 20 minutes- non-detectable. This study validates the utilization of air-frying technology for the brownie baking process at 350 °F for at least 20 minutes is an effective kill-step in reducing a Salmonella serovar population. Future investigations should look at air fryer capabilities to inactivate various microorganisms with inoculated alternative flours.

196

Name: Jian, Xinyan

Major: Biomedical Engineering

Faculty Advisor: Raju Bheemanahalli, Plant and Soil Sciences

Co-Author(s): Ranadheer Reddy Venman, Jagman Dhillon, K.Raja Reddy

Funding: College of Agriculture and Life Sciences URSP

Pre- and Post-Anthesis Drought Stress Impact on Corn Yield

Corn consumes a significant amount of water during the reproductive stage. Inadequate soil moisture around this stage could inhibit tassel emergence and cause abnormal ear formation. Such abnormalities during the reproductive stage can decrease the number of harvestable kernels per ear. On the other hand, rainfed corn-growing regions in the USA are often exposed to inadequate soil moisture during tasseling. Despite the sensitivity of these stages to inadequate soil moisture, the interaction between the time of irrigation and yield at different phenological stages has been overlooked. In this study, we quantified the impact of drought stress on different phenological stages targeting physiology, yield, and kernel quality using the Dekalb hybrid. Drought stress was imposed by withholding irrigation for seven days targeting: (i) tassel initiation, (ii) peak flowering, and (iii) after pollination or blistering. Physiology and pigment data were collected at the end of drought stress at each growth stage. After 7-day of drought stress, pots were rewatered or maintained under non-stress conditions until physiology maturity. At maturity, plants were hand-harvested and examined for drought stress effects on yield potential (kernel number, weight, 100-kernel weight) and quality (starch and protein). Drought stress imposed at different growth stages significantly reduced stomatal conductance, transpiration, and other photosynthesis-related pigments. Data obtained from the three treatments showed that drought stress considerably affected kernel number, kernel weight, and single kernel weight ($p < 0.001$) across three growth stages. However, seven days of drought stress before anthesis resulted in greater yield loss, followed by the other two growth stages, indicating greater sensitivity of this stage to drought stress. Our finding suggests that the most beneficial water use can be achieved by supplying optimal irrigation to corn fields around tasseling.

23

Name: Jiles, Matthew

Major: Aerospace Engineering

Faculty Advisor: Ariunbold Gombojav, Physics & Astronomy

Developing a Quadcopter to be used for Plant Health Monitoring

UAVs (Unmanned Aerial Vehicles) are aircraft that are designed to fly without the assistance of a pilot. The use of small UAVs or drones has become a popular tool for many fields because of their versatility and effectiveness in gathering data. The UAV platform has also become a good option for the agricultural sector as these drones can provide a fast and reliable way for farmers to monitor the health

of their crops. For an autonomous drone to be successful in this space, there is a need for a system that can not only decide when and where to take data but also be able to avoid large obstacles along its flight path. In this paper, the authors will discuss the process of researching and developing the avionics for a drone that can monitor plant health using off-the-shelf components. The project's current state and future plans will also be discussed in this paper.

199

Name: Jones, Erin

Major: Psychology and Data Science

Faculty Advisor: Matthew Brown, Biology

Co-Author(s): Nicholas Gibson, Robert E. Jones, Quentin Blandenier, Alexander K. Tice, Brendan Zurweller,

Pipeline for long-read protist metabarcoding from diverse environments

The 18S rRNA gene is a commonly used marker for studying eukaryotic diversity in various environments. Oxford Nanopore long-read sequencing technology offers longer reads than previous technology, making it a promising approach for full-length eukaryotic 18S metabarcoding. In this study, we developed a pipeline for full-length eukaryotic 18S metabarcoding using Oxford Nanopore sequencing technology. DNA was extracted from environmental samples and the 18S rRNA gene was amplified. The resulting amplicons were used to construct libraries, sequenced using the Oxford Nanopore platform, and analyzed using our custom pipeline. The pipeline included quality control, read filtering and trimming, taxonomic classification, and statistical analyses. Our pipeline demonstrated high accuracy and resolution in identifying diverse eukaryotic taxa, including rare and novel taxa. Furthermore, using full-length reads allowed us to classify most sequences accurately. In conclusion, our study demonstrates the effectiveness of using Oxford Nanopore long-read sequencing technology in full-length eukaryotic 18S metabarcoding studies. The developed pipeline can provide a more accurate and comprehensive understanding of eukaryotic diversity in various ecosystems, enabling better monitoring and managing of these important communities.

198

Name: Jones, Kristian

Major: Animal and Dairy Science

Faculty Advisor: Derris Burnett, Animal and Dairy Sciences

Co-Author(s): Jamarah Wright, Ryen Greer, Kenisha Gordon

Funding: College of Agriculture and Life Sciences URSP

Effect of Leafy Vegetables vs Pellet Diets on the Meat Quality of Rabbits

Rabbits are convenient sources of palatable and nutritious meat, high in protein and low in fat and cholesterol (Ezema and Eze, 2015). The study examines the effect of feeding leafy vegetables and fruits on the post-harvest qualities of rabbit meat. For this study, sixteen weaned cross breeds at 7 weeks of age (2.16lbs) were allotted to one of two diets in a completely randomized design with eight replicates. The control/basal diet consisted of 150g ware rabbit pellets while the treatment diet had 200g vegetables and fruits (cilantro, radish, lettuce, carrots, and apples). The rabbits were housed in individual cages, with *ad libitum* access to water and bermudagrass hay and the experiment was conducted for 4 weeks with 7 days of adaptation. The time span of the study will allow the rabbits to reach a common timepoint to ensure a proper assessment of the meat yield and composition. When looking at the proximate analysis of both the pellets and the vegetable/fruit mix, it is seen that the pellets produce higher value due to a more balanced protein to fat ratio. Therefore, it is hypothesized that the rabbits receiving the pellet diet will present greater growth performance and better carcass quality. The physicochemical properties (pH, color, cook loss) and nutritive components will be assessed after harvesting and intermittently during storage. Overall, this study will help contribute essential data regarding meat rabbit production to the growing industry.

106

Name: Jones, Landry

Major: Kinesiology

Faculty Advisor: Chih-Chia Chen, Kinesiology

Co-Author(s): Alex Rangel

Executive Function Promotion Through Adapted Soccer Activity for Young Adults with Intellectual Disabilities

PURPOSE / AIMA plethora of studies have proven the positive impact of physical activity on cognitive health in typical populations. Yet, relevant experimental studies that focused on individuals with intellectual disabilities (ID) are still scarce. This study aimed to explore the effects of adapted soccer activity on executive functions in young adults with ID. METHODS: Twelve participants (10 males, 2 females, aged 19-26) practiced soccer activities with their typical partners twice a week for five-week long. Two participants (2 females, aged 20-23) participated as the control group. The control group was asked to continue their regular daily regimen The Corsi block, simple reaction time, and mental rotation tests (adapted from PsyToolkit) were conducted before and after the program to measure working

memory, processing speed, and spatial reasoning capabilities. RESULTS: A separate Wilcoxon signed-rank test in the exercise and control group respectively was conducted to evaluate the effect of the intervention. The exercise group had significant improvements in processing speed and spatial reasoning capabilities. However, no significant changes were evident in the control group. IMPLICATION / CONCLUSION This study suggested the adapted soccer program might promote cognitive benefits in young adults with ID. Future research needs to be examined with a larger sample size. In addition, other neuroimaging and physiological measures should be applied to explore the underlying mechanisms among individuals with ID.

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Name: Jones, Sophie

Major: Biomedical Engineering

Faculty Advisor: Lauren Priddy, Agricultural and Biological Engineering

Co-Author(s): Adrian Andrews, Katherine Flannigan, Khaoula Khmal

Funding: ORED Undergraduate Research Program

Comprehensive Evaluation of Hydroxyapatite Coatings to Improve Degradation Characteristics of Additively Manufactured Porous Magnesium Implants

Standard metal implants for bone fracture fixation can present problems including implant loosening, bacterial infection, and the need for a second surgical procedure. The purpose of this project is to develop biodegradable implants that will temporarily perform the function of the bone for mechanical stabilization until the newly formed bone tissue can replace it. Magnesium alloys show considerable promise for biodegradable implants considering their biocompatibility, osteoinductivity, and mechanical properties comparable to natural bone. Nonetheless, magnesium degrades too rapidly in the physiological environment of the body. To mitigate this, a calcium phosphate which occurs naturally in bone, hydroxyapatite, can be applied as a coating to the magnesium. Our prior work demonstrated hydroxyapatite coating reduced the degradation rate of solid magnesium discs, and others have shown hydroxyapatite can improve the biological activity of magnesium, fuse with host bone tissue, and biodegrade. Additive manufacturing (AM) enables creation of porous magnesium scaffolds to enhance osseointegration and tuning of scaffold properties to mimic native bone tissue. First, we evaluated the degradation of AM magnesium alloy (WE43) solid cylindrical samples. This study demonstrated that various printing parameters for WE43 showed the same degradation rate. Then, we studied the impact of hydroxyapatite coating on the degradation rate of pure magnesium solid samples. The mass loss and height difference data in this study supported our original hypothesis that coated samples would degrade more slowly than non-coated samples. Now, we are modifying the hydroxyapatite coating method for AM WE43 porous scaffolds and evaluating effects of the coating on degradation rate. With the advantage of AM, an efficient method of HA coating of magnesium could enable the degradation rate needed for a temporary bone substitute.

200

Name: Jones, Tanner

Major: Biomedical Engineering

Faculty Advisor: Lauren Priddy, Agricultural and Biological Engineering

Co-Author(s): Caitlin Luke, Micah Foster, Halleigh Faulkner, Dani Janus, Matthew W. Priddy

Funding: Medtronic

Replication of impact parameters from cadaveric lumbar interbody fusion using a benchtop device

Transforaminal lumbar interbody fusion (TLIF), the insertion of an interbody fusion device (IFD) between vertebrae of the lumbar spine, is performed to relieve lower back pain caused by disc pathologies. The IFD is inserted in the disc space via malleting of an insertion tool, a process which can damage the IFD. Cadavers are traditionally used for testing of IFDs, but cadavers involve intensive preparation and are not easily accessible to many researchers, so benchtop devices are needed to provide reproducible experimental conditions that mimic cadaveric experiments. In this research, a drop weight benchtop device was constructed and outfitted with sensors to measure four key impact parameters: (i) slope of the impact wave, (ii) peak force, (iii) area under the curve, and (iv) impact duration. Cadaveric data was collected using the TLIF procedure to validate the results of the benchtop device. Upon comparison of cadaveric and benchtop device testing data, modifications were made to the benchtop device to better mimic cadaveric testing in these four key waveform characteristics. Following these changes, further testing of the TLIF procedure was completed with the benchtop. Currently, the objective is to extend the benchtop device capabilities to replicate another fusion procedure, the anterior lumbar interbody fusion (ALIF), which requires further modification of the benchtop device to accommodate larger implants and insertion tools. The long-term goal of this research is to replace cadaveric experiments for lumbar interbody fusion procedures with a robust and versatile benchtop device.

107

Name: Jones, Tyreek

Major: Psychology

Faculty Advisor: Deborah Eakin, Psychology

Would You Survive? Investigating Survival Effects in Implicit Memory

One theoretical viewpoint is that memory has evolved to retain information based on its survival relevance (Nairne et al., 2007). The survival effect has been shown by having people rate a list of random words for their relevance to either surviving being stranded on a foreign grassland or for moving. Those who rate words as relevant for survival recall more words than those who rate words as relevant for moving. Subsequent research has provided conflicting reports, however, calling into question the robustness of the effect. However, in all cases, the type of memory being tested was explicit memory. Explicit memory involves conscious learning and retrieval of information. In contrast, implicit memory is memory that is automatic and used without conscious effort. In terms of evolutionary terms, implicit memory is “older” than explicit memory. Therefore, we hypothesized that survival effects would be more likely to be obtained in implicit, than explicit memory. Under the guise of helping to develop future experimental materials, participants read a scenario about being stranded on a foreign grassland or moving. They were presented a list of 30 words (e.g., BEEF) and rated each on a scale of 1 -7 (not relevant-to-very relevant) to the scenario presented. (There was no mention that these words should be remembered for any reason.) After a set of filler tasks designed to distract participants from the rating phase, a list of word stems was provided (e.g., BE_ _) and participants were asked to complete the word stem with the first word to come to mind. Half of the words could be completed with a word that had previously been rated for relevance. The results will be discussed in terms of whether survival effects occur during implicit memory.

67

Name: Kairschner, Kathryn

Major: Human Development & Family Science

Faculty Advisor: Tommy Phillips, Ph.D., Human Sciences

Co-Author(s): Alexandra Owings, Marshall Standley, Kellie Williams

How Social Media Influencers Affect Buying Behaviors

Social media use continues to increase, especially among young adults and college students (Croes & Bartels, 2021), and there has been an increase in buying products based on what social media influencers say is good (Saima & Khan, 2020). Research exploring the relationship between social media influencers and the buying behaviors of young adults and college students is important because of the growth in social media use in society as a whole and the impact that it has on everyday lives of users. The objective of this study was to collect information from college students through an online survey asking about the social media apps they have, how often they use those apps, who they follow on those apps, and their buying behaviors, especially of popular products advertised on social media. The present study was intended to gain a better understanding of the effects social media influencers have on people, especially the buying behaviors of individuals ages 18 to 30. It was hypothesized that the social media habits of 18-to-30-year old's and the social media influencers these users follow impact the buying behaviors of the individual. Our hypothesis was tested using correlational analysis.

201

Name: Kalmbach, Catherine

Major: Animal and Dairy Science

Faculty Advisor: Derris Devost-Burnett, Animal and Dairy Sciences

Funding: College of Agriculture and Life Sciences URSP

Optimizing breed-specific nutritional regimens to improve reproductive performance, meat quality and carcass yield of contemporary meat rabbits.

In the Western Highlands of Totonicapán Guatemala, malnutrition, and lack of upward economic mobility has created a vicious cycle of generational poverty and despair. Many in this impoverished area have limited access to adequate nutrition and over 70% of the children suffer from physical and/or developmental stunting. Many more suffer from “hidden hunger” in which overall body condition appears normal but due to the scarcity of essential nutrients, their growth and developmental trajectory is permanently compromised. These impairments persist into adulthood and fuel the cycle of deficiency and developmental stagnation. There is a critical need to educate and empower these underserved global communities. We have developed a comprehensive research and teaching program that trains our students to train the Guatemalan families to raise and harvest meat rabbits to mitigate these nutritional and economic challenges. In furtherance of this program, the objective of the current proposal is to determine the impact of breed and diet formulation on reproductive performance, feed efficiency, and carcass quality of market rabbits. 24 weaned does from 4 common breeds will be fed one of two diets (homegrown forages vs. commercial pellets) in a 4 x 2 factorial treatment arrangement. These does will then be bred to a single buck and their offspring will be raised to a common weight endpoint before being harvested to determine meat yield and composition. Reproductive and growth performance analysis will be conducted to inform our audience on the optimal breed and nutritional combinations that maximize quality and quantity of meat produced.

108

Name: Kamal, Khaoula

Major: Biomedical Engineering

Faculty Advisor: Ann Sansing, Food Science, Nutrition, and Health Promotion

Methods for Evaluating Effectiveness and Responsiveness of Rural Medical and Science Scholars

Rural Medical and Science Scholars Program (RMSS) is an intensive summer program with the goal of increasing rural healthcare literacy in young adults as they make future career choices. With the use of excel software and program tracking, RMSS Community Health interns aim to quantify the benefit RMSS has on the state of Mississippi. By analyzing the ongoing successes and failures of the program, there is an expanding, dire demand to quantify the factors relating to this experience ranging from impressions made on STEM-oriented high-school students to the growing support of community members. The program consists of a plethora of scientific objectives that seek to expose students to medical tasks while engrossed in a college-level curriculum that prepares them for the discipline of post-secondary education. With an emphasis on medical undertakings, the session targets key subject matters such as performing proper sutures, building hypothetical, strong communities, and simulating the impacts of common disabilities through empathetic practices. By engaging with potential pre-medical or health-oriented individuals, RMSS enables the development of more primary care physicians for the rural state of Mississippi—especially through the promotion of the Rural Medical Physicians Program offered by the University of Mississippi Medical Center. Throughout this venture of implementing RMSS, the program has been profoundly advertised across dozens of counties in MS which have empowered the transformation of the project as it has progressed over time. This study exhibits the responsiveness of modifying the primary factors of the program by using the output of healthcare positions and statistical data from a variety of surveys whilst reviewing the distinctive and general impacts these changes have fostered. By utilizing a database that aggregates these elements, a thorough review of the social and economic impact of RMSS can be evaluated.

109

Name: Kellen, Kennedy

Major: Psychology

Faculty Advisor: Deborah Eakin, Psychology

Co-Author(s): Ronne McDonald

Better Than Quizlet: Read-Recite-Review is the Better Study Activity

Prior research shows that rereading is a poor study activity because it does not encourage elaboration on to-be-remembered concepts. Study activities that use elaborative retrieval process produce better long-term memory performance. During elaborative processing, connections are made among concepts and multiple cues are linked to the studied concepts, which will later facilitate memory. One form of elaborative processing that has been shown to outperform rereading is testing. The Test Effect (Roediger & Karpicke, 2006) demonstrates that, after reading a passage, students who take an immediate test do better on a final test than a group who rereads the passage. This finding suggests that, for optimal performance on exams, students should take practice tests rather than reread study materials. However, students are poor at generating questions that test the same material that will be on the final test (Kelly et al., 2019) and require significant training to do so (Weinstein et al., 2010). The goal of the present study was to determine whether students who used a study activity that combined rereading with elaborative retrieval processes would do better on a final test than those who used testing. The Read-Recite-Review (RRR) study activity was compared to testing. RRR had students read a passage and then recite everything they could remember about the passage out loud (without looking at the passage) and then read the passage again. Reciting what they remembered about the passage encouraged elaborative retrieval processing and rereading the passage continued that process by allowing them to further elaborate on information they missed or got wrong. Results showed that performance on a final test was better for RRR than for testing. This study shows the benefits of elaborative retrieval processing on long-term memory in the absence of a formal test.

202

Name: Kemp, Jennifer

Major: Biomedical Engineering

Faculty Advisor: David Van den Heever, Agricultural and Biological Engineering

Analyzing Brain Activity while playing E-Sports

Video gaming is known to enhance a range of cognitive functions such as hand-eye coordination, reaction time, and eye tracking. This study aims to examine the differences in EEG Alpha and Beta power between amateur video gamers and expert video gamers. EEG Alpha waves (8-12Hertz) are present during a wakeful state. Females tend to have a higher Alpha mean frequency than males. Beta waves (13-30Hertz) are present in an alert and conscious state, and they also occur during a deep sleep period. The electroencephalogram, also known as an EEG, measures the real-time cognitive activity in the brain. To investigate the effects of winning versus losing, 12 participants (6 amateurs and 6 experts) were recruited to play Super Smash Brothers on a Nintendo Switch.

First, the participant's baseline of their psychological state was obtained with eyes open and closed for 2 minutes. Each participant then completed 10 practice trials and recorded 60 trials within 2 hours, while the winning versus losing ratios were being recorded. The parameters for this experiment were based on the participant's experience level, in which the CPU and difficulty level were changed. Matlab was used to analyze the frequency response, also known as power spectral analysis. The purpose of this analysis is to observe any trends related to the power of the frequency bands. These trends can reveal new perspectives regarding brain activity that can lead to the optimal performance of an e-gamer. With these new perspectives, approaches using brain activity associated with winning can enrich the training experience with positive results.

203

Name: Keowen, Breann

Major: Animal and Dairy Science

Faculty Advisor: Trent Smith, Animal and Dairy Sciences

Funding: College of Agriculture and Life Sciences URSP

Evaluation of the relationship between hair coat shedding ability and apparent digestibility in Angus cattle

The objective of this study was to evaluate the association of winter hair coat shedding ability and apparent digestibility in Angus cattle. Data were collected on purebred Angus females in 2019 (n=10), 2020 (n=31), 2021 (n=39), and 2022 (n=41). Dams were observed once monthly by two trained technicians beginning the third week of March at 30d increments until July. Hair shedding was evaluated with a visual score ranging from 1 to 5, with 5 indicating no shed and 1 indicating complete shed. The month of first shed (MFS) was determined when the hair shedding score was \leq to 3.5. Cattle reaching their MFS before May were classified as early shedders (ES), while cattle reaching MFS after May were classified as late shedders (LS). Fecal samples were collected in March, May, and July for 5 consecutive days to determine apparent forage digestibility and were analyzed via proximate analysis for dry matter (DM), neutral detergent fiber (NDF), acid detergent fiber (ADF), and ash. Data were analyzed using SAS with significance declared at $P \leq 0.05$. The model included MFS, grazing month, and MFS by grazing month interaction and differences were determined by LSD. Month of first shed by grazing month was significant for DM ($P < 0.0001$), NDF ($P = 0.0007$), ADF ($P < 0.0001$). There was an effect of grazing month for ash. These results show an association between hair shedding ability and apparent digestibility; however, the exact relationship is unclear. Further research would be necessary to understand how adaptability of cattle can affect apparent digestibility.

24

Name: Keyes, Kennedy

Major: Software Engineering

Faculty Advisor: Daniel Carruth, Center for Advanced Vehicular Systems

Funding: ORED Undergraduate Research Program, B.R.I.D.G.E.S.

Accessible Virtual Reality: Identifying and Addressing Common Challenges for Users with One-Handed Limitations

Many virtual reality (VR) applications do not provide accessibility support for people with disabilities. Most applications require the use of two controllers, which poses challenges for people with one-handed limitations. However, these challenges can be addressed by bringing attention to ways to accommodate those needs. Our two objectives were: (1) to survey ten applications to identify challenges that arise when restricted to a single controller; and (2) to develop recommendations for enhancing accessibility in VR. In 5 of the applications, controlling movement was challenging, and in all 10 applications, interacting with menus and interfaces was difficult. Menus were linked to the position of the non-dominant hand, and for users with one-hand limitations, the menu could not be accessed. And in certain virtual environments, users were required to use both controllers to rotate and move forward, unless the environment solely relied on headset tracking for movement. Headset tracking can be an issue if the users are in a limited space or cannot move their bodies freely. The recommendations include placing interfaces in fixed or relative positions in the environment and sharing the mapping inputs for both controllers to control movement. Modifications to the controls would allow people with disabilities to use the systems. However, especially in VR, support must be built by developers. Increasing awareness within development communities is paramount to ensuring accessibility for all users. Software developers can create accessible features that benefit gameplay and user experience. To ensure that these features are effective, further research should: (a) test applications with modified inputs to determine whether a single controller can handle multiple controls; (b) implement an accessibility setting in the application; and (c) conduct user studies with individuals to examine their gameplay performance and preferences. Addressing these problems will enhance the inclusivity and enjoyment of virtual reality.

204

Name: Khadgi, Anamica

Major: Biomedical Engineering

Faculty Advisor: Amy Dapper, Biological Sciences

Funding: Shackouls Honors College Research Fellowship

Genomics of Recombination Rate in *Caenorhabditis elegans*

Recombination, the exchange of homologous chromosomes that occurs during meiosis, contributes, alongside mutation, to the genetic variation observed in natural populations. Although this process is highly regulated, studies have shown that the rate of recombination is highly variable between chromosomes, genome, individuals, sexes, populations, and species. This variation has important cellular and evolutionary consequences. Developing a practical model system to study the genetics of recombination rate variation will accelerate advances in this field. *Caenorhabditis elegans* is a promising candidate, however little is known about how recombination rate varies between laboratory strains. Prior research in the Dapper lab found that the recombination rate is significantly different in two important experimental strains (CB486 and N2) using patterns of inheritance of fluorescent markers. However, this observation could be due to differences in the frequency of recombination events (genetic distance) or because the fluorescent markers are further apart (physical distance). To differentiate between these alternatives, I sequenced the genomes of the laboratory strains used to measure recombination rate. Analyzing the genomic data allows me to measure the physical distance (number of base pairs) between the two fluorescent markers in each strain and determine whether the observed elevation in recombination rate is due to differences in genetic or physical distance. Understanding variation in recombination rate in model organisms is instrumental in developing more comprehensive genetic and evolutionary models, thus bridging the existing knowledge gaps in the field.

205

Name: Khanal, Prabesh

Major: Computer Science

Faculty Advisor: Gary Feng, Plant and Soil Sciences

Co-Author(s): Huang Yanbo

Analysis of Big Spatiotemporal Data: NASS reported and APEX simulated Soybean Acreage and Yield in the Southeast USA

Estimation of crop yield with approximate acreage is critical to crop production management decision support. This research aims to estimate the soybean acreage yield and in Mississippi State during the wet, normal and dry years using APEX (Agricultural Policy/Environmental eXtender) model. APEX model uses data from the past to establish the trend such as rain average, precipitation, soil type from area, wind etc. to determine how the current crisis can affect the future of agriculture and is capable of long term (1- 2000 years) simulation of the fields ranging from small scale to cross-country boundary. The results from the research provide valuable information on the total area of soybean planted and the total yield of specific soybean fields of every county in Mississippi. The APEX model was implemented by utilizing various databases, including data of soil, weather, crop, field management, and spatial locations. The Gridded Soil Survey Geographic Soil Map (gSSURGO-30) (USDA Natural Resources Conservation Service (NRCS)) and the Gridded Cropland data layer (CDL-30m) (USDA National Agricultural Statistics Service (NASS)) were downloaded and then uploaded into ArcGIS to apply Spatial Analyst tools in ArcGIS (ESRI, Redlands, CA) to overlay and clip the two data layers to fit into the area of interest. Accordingly, weather data, such as wind, precipitation, daily/monthly temperature, and soil data, were converted into the required format for APEX model with programming. Then, APEX model was used to simulate soybean yield for individual fields and the total yield for all fields in each county of the entire state. The output from APEX model was compared with the total area of soybean field planted and yield data reported on the USDA NASS website. The study will contribute to improving accuracy of those NASS reports for stakeholders in commercial community and researchers in scientific community.

206

Name: Kilgore, Meg

Major: Biochemistry

Faculty Advisor: Samuel Ward, Biochemistry, Molecular Biology, Entomology, and Plant Pathology

Co-Author(s): Afsoon Sabet, Jerome Goddard

Funding: College of Agriculture and Life Sciences URSP

Behavior of the colonized Gulf Coast tick, *Amblyomma maculatum* Koch, and the lone star tick, *A. americanum* L., under different ecological conditions

Ticks are the primary cause of vector-borne diseases in the United States, with annual case numbers rising steadily despite underreporting. Notwithstanding the importance of these arthropods to public health, information regarding their behavior in different environments is scarce. Here, we investigate the behavior of two tick species, *Amblyomma maculatum* and *A. americanum*, by creating arenas to simulate different ecological conditions. Four ticks were placed in arenas with one or both species, with different substrates (rock, sand, soil), and were maintained at different temperatures (16/22 C°). We found that regardless of species composition and temperature, the ticks were most likely to quest when on sand and most likely to burrow when on soil and the rock. We hope these results further the collective understanding of tick behavior, a potential area of future management interventions.

110

Name: King, Laura Grace

Major: Educational Psychology

Faculty Advisor: Arazais D. Oliveros, Psychology

Examining curriculum requirements of undergraduate teacher preparation programs to gauge educator knowledge of trauma-informed education frameworks

Statistics show that many pre-K–12 students in the United States are exposed to adverse childhood experiences (ACEs) or potentially traumatic events (PTEs), and a growing body of literature points to these childhood experiences harming children’s academic functioning and future educational attainment. A review of the literature on trauma-informed education (i.e., curriculum and programs designed to mitigate the negative effects of trauma) highlights many teachers’ lack of confidence in combatting issues within student populations affected by adversity and trauma; the research also indicated that teachers with knowledge of trauma/adversity and its implications are crucial to effectively educating at-risk children and adolescents. The current study examines teacher education curricula at 119 postsecondary institutions accredited by both the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC) and the Council for the Accreditation of Educator Preparation (CAEP) to identify existing course requirements that fit each of four dimensions of many trauma-informed education programs: Adversity and Resilience, Human/Child Development, Child/Educational Psychology, and Human/Cultural Diversity. Primary and secondary education majors were examined separately for inclusion of these dimensions and compared. Results show that only one of the 119 universities’ primary education programs required courses in Adversity and Resilience; none were required among the secondary education programs. At least one course in Human/Child Development was required by 52% of primary education programs and 46% of secondary education programs; Child/Educational Psychology by 55% and 51%, respectively; and Human/Cultural Diversity by 57% and 50%, respectively. This examination forms part of an ongoing evaluation of teacher education standards and educator preparedness to implement trauma-informed education interventions. Results suggest a need for additional training and professional development for educators, especially given the prevalence of child traumatic stress and the growing number of policies and initiatives promoting trauma-sensitive schools.

48

Name: Kirkpatrick, Annie

Major: English

Faculty Advisor: Dhanashree Thorat, English

Can I Get an Amen: The Role of the Black Church in the Civil Rights Movement

As an institution, the Black Church has and continues to be an integral part of African American culture. This paper discusses its role in the nonviolent protests of the Civil Rights Movement specifically, building upon existing research (Calhoun-Brown, 2000; Johnson, 1986; King, 1971) by analyzing primarily Martin Luther King Jr.’s “Where Do We Go From Here” and secondarily Fannie Lou Hamer’s “I Don’t Mind My Light Shining.” I will argue that the rhetorical strategies in these speeches draw upon Black Christian theology to characterize the activists as a new generation of Chosen People. In framing the Movement this way, King allies their cause with the will of God, making success inevitable, and both speakers re-dignify Black Americans as valued human beings, giving them a heavenly nation to claim over their political one that denies them their rights as citizens. My secondary point in this argument is that identifying with the Israelites comes with the responsibility to adhere to the same moral code which would condemn violent demonstrations. With appeals to specific verses, King and Hamer keep their listeners allegiant to nonviolent methods. I will then argue that the Black Church’s doctrine enabled King to call for nationwide repentance and reconciliation instead of war. King asks that his audience not fight for power over white Americans but rather for equality with them, basing his argument entirely in the idea of “Christian love” which emphasizes healing broken relationships (King, 1967). This message, I conclude, was instrumental in making multitudes of Americans receptive to the nonviolent protests of the Civil Rights Movement and has the potential to continue improving racial tensions today.

25

Name: Koehler, Leon

Major: Mechanical Engineering

Faculty Advisor: Sathish Samiappan, Geosystems Research Institute

Funding: Robert J. Moorhead’s Billie Ball Professorship & IslandConservation.org

Hyperspectral Classification of Invasive Species by using Uncrewed Aerial Systems

Wildlife management, especially the detection and classification of invasive species on remote islands, is a challenging task that requires efficient and reliable methods. Current techniques involve the use of crewed aircraft, labor intensive inspection, or wildlife game cameras. These methods can be expensive and involve human labor, yet they only capture a small portion of the areas of interest. The management of invasive species is critical for preserving the native habitat, as failure to control them may displace or eradicate the native species. Adequate measures can only be deployed if an accurate count of the animals is estimated. Hyperspectral imagery (HSI) captured from small uncrewed aerial systems (UAS) can record reflected light, ranging from the visible to near-infrared wavelengths.

Each object has a unique reflection pattern, or hyperspectral footprint. Similarly, the skin of various species all have unique hyperspectral footprints. This research focuses on HSI data acquired from a UAS to automatically detect and classify four medium-to-large animals. The aim of the study is to evaluate the efficacy of HSI in identifying these species. Initial data analysis included the use of simple statistical analysis in the comparison of spectral bands. Afterwards, supervised maximum likelihood classification of pixel groups was used to determine the variance for each spectral band, both within and between the species. The data was then fed into an artificial neural network (ANN), which trained a model to accurately predict new animal data. The experimental results show that it is possible to distinguish the species by analyzing their hyperspectral footprint. The ANN allows for automated classification, which drastically reduces the labor intensity of the process. This research demonstrates the potential of HSI paired with the use of ANNs in efficiently and accurately identifying invasive species, which can ultimately help in managing their populations and protecting the native habitat.

26

Name: Koloc, Jackson

Major: Physics

Faculty Advisor: Dipangkar Dutta, Physics and Astronomy

Funding: US Department of Energy, Office of Science

Implementation of Bayesian Analysis to Refine the Definition of the Proton Charge Radius

The proton has been a subject of study for over a century now, and yet, so much is still not known about it. One of the more prevalent characteristics of the proton is its RMS charge radius. The PRad experiment was conducted in order to try and measure this charge radius by utilizing a windowless hydrogen gas target with a low beam background, a very low momentum-transfer range, and an environment that allows electron-proton and electron-electron scattering to be deleted simultaneously. This method allowed for a precise control of the systematic uncertainties to try and extract the most accurate measurement of the proton radius possible. Using previous data from the PRad experiment and a program that utilizes a method called Bayesian Analysis, we are trying to extract the proton radius with a smaller error range. Bayesian Analysis aims to continually learn from previous information gathered from this experiment allowing it to build upon itself and ultimately achieve a much more precise measurement. By running our data from the PRad experiment through a computer program called netmaker, which is a program that utilizes machine learning alongside Bayesian analysis, we were able to extract the charge radius of the proton with a much smaller error.

207

Name: Laird, Tanner

Major: Agricultural Science

Faculty Advisor: Heather Jordan, Biological Sciences

Co-Author(s): Cedric Gainwell, Garrett Lofton, Charlotte Sarver, Jordan Smink, Christine Williams, Chris Dallager

Funding: NSF Research Experience and Mentoring

ACCESS FRASS: Exploring Black Soldier Fly (*Hermetia illucens*) Frass as Soil Amendment to Promote Corn Growth and Soil Quality

Insects, such as black soldier flies (*Hermetia illucens*), are showing great promise for valorizing agricultural wastes to products of value. The larvae themselves can be used to feed animals and humans, and remaining frass-digestate is increasingly gaining momentum worldwide as a soil amendment. However, research on appropriate amendment quantities and its performance on crop production remains largely unknown. Furthermore, little is known about how the insect diet impacts frass quality and resulting soil quality and plant growth. We used pot experiments and planted corn to measure the impact of two differing amounts of frass amendment on soil quality (i.e., pH, moisture, temperature), and resulting above and below ground plant growth, number of leaves, and chlorophyll. We also collected soil samples at the beginning and end of the experiment to measure soil chemistry and microbial community. We hypothesized that increasing quantity of frass amendment will lead to corn growing taller and more rapidly than control corn with no frass addition, because the frass is nitrogen filled and the corn is a nitrogen loving plant. We also hypothesized that frass will positively affect the soil growth efficiency through nutrient enrichment and will increase soil moisture with increasing frass amendment. We tested our hypotheses over 8 weeks with two treatment groups and a control group (each in triplicate), using processed frass (dried through forced aeration) from a commercial vendor. The control group had no additional frass, and treatment groups either had 7.5g frass/pot (mid) or 15.0g frass/pot (high) added to soil for a total of 1000g soil/frass. Corn was planted into either control or treatment containers and watered twice per week. Measurements for soil moisture, pH, and temperature were measured weekly. Once seeds sprouted and plants grew, plant height, leaf number, root length, and chlorophyll were also measured weekly. Overall, our findings will add to the growing data on the use of frass as a soil amendment, with implications for measuring the value of frass as a product to improve soil quality and plant growth that impact agriculture sectors through development of sustainable ways to add nutrients to grow food plants. Furthermore, valorizing frass could aid in decreasing costs for growing crops, allow for new employment opportunities, and increase the profitability of insect farming to US farmers and in developing countries.

27

Name: Laird, Will

Major: Chemical Engineering

Faculty Advisor: Todd E. Mlsna, Chemistry

Co-Author(s): Prashan M. Rodrigo, Frank Brigano, Bryan Eagle, Charles U. Pittman Jr.

Funding: Creekside Environmental Products

Remediation of Cu(II) Contaminated Wastewater from Rice Husk Biochar and KOH-Modified Rice Husk Biochar

Copper has several ways of entering waterways, such as industrial runoff, mining waste, ablative boat paints, etc. In the past, there have been several methods to remove copper from waste streams. Rice Husk Biochar (RHBC) works by adsorbing copper and other metallic ions from the water. Rice Husk is one of the largest agricultural residues in the world, so it is a very common feedstock to make biochar. Fixed-bed continuous flow treatment is important in large-scale water treatment plants. In this project, three-column studies were performed. Firstly a 50 cm length and 2.54 cm dia column packed with 35 g of rice husk biochar and a breakthrough study was performed at 0.5 mg/L initial Cu(II) concentration at pH 5, by down-flow elution at 82.58 mL/min flow rate and the sorption capacity was 2.41 mg/g. Secondly and thirdly, other column experiments were performed with a 27.5 cm and 50 cm length and 2.54 cm dia column packed with 35 g and 60.6 g of KOH-modified rice husk biochar with the same experimental conditions. The column sorption capacities were 7.82 mg/g and 7.68 mg/g, respectively. The effect of initial solution pH, sorption kinetics, and sorption isotherm experiments were carried out in batch mode. Batch sorption studies were performed with rice husk biochar to compare the sorption capacities of Cu(II) to Ba(II), Hg(II), Pb(II), Mo(VI), Mn(II), Fe(III), Cd(II), Cr(VI) and Zn(II) at pH 5, 6.5 and 8.5 respectively. The rice husk biochar and KOH-modified rice husk biochar were characterized using elemental analysis and powder X-ray diffraction techniques.

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Name: Lakshminarayanan, Shreenithi

Major: Chemical Engineering

Faculty Advisor: Amanda Patrick, Chemistry

Co-Author(s): Taofiq Abdulraheem

Gas-Phase Dissociation Patterns of BVIM

With the potential use of ionic liquids (salts that are liquid at temperatures near room temperature) as additives, lubricants, solvents, and more, it is essential for research efforts to focus on the stability and degradation products of these ionic liquids. These degradation products could interfere with the intended use or become persistent pollutants as industrial use expands. The focus of this work is to contribute toward a molecular-level understanding of ionic liquid thermal degradation through mass spectrometric studies. Specifically, in this study, the gas-phase dissociation patterns of the mono-cation and di-cation versions of 1-butyl-3-vinyl imidazolium (BVIM) cation are evaluated through collision-induced dissociation mass spectrometry (CID-MS). This study fits within a larger effort to compare and contrast the effects of mono- versus di-cations and the anions with which they are paired on the thermal stability as evidenced through gas-phase dissociation (presented here), thermogravimetric analysis, pyrolysis-GC-MS, and bulk degradation analysis. CID-MS experiments were carried out on a Thermo LTQ Velos ion trap mass spectrometer, equipped with a positive-mode electrospray ionization source. The mono-cation, di-cation, and di-cation clustered with an anion of BVIM were individually isolated and subjected to CID. The neutral losses and likely product ion identities were determined manually. Structures for product ions and neutral losses were proposed based on the analysis and chemical rules. The di-cation of BVIM had the most complex dissociation pattern, often involving the removal of one of the imidazolyl rings along with some portion of its attached alkyl chains, while the mono-cation had only one dominant fragment ion from loss of the butyl chain. Further observations regarding the proposed dissociation pathways will also be discussed.

208

Name: Landrum, Anna

Major: Biomedical Engineering

Faculty Advisor: Sungkwang Mun, Center for Advanced Vehicular Systems

Co-Author(s): Adriana Mays

Developing Antibacterial Surface on Titanium alloy

The present study was investigating the effects of hydrothermal etching on titanium alloy to develop an antibacterial surface. An antibacterial surface is very vital in many medical procedures, and it can prevent the growth of bacteria on surfaces of a material implanted into the body which would help these materials last longer by preventing infections that come from the growth of bacteria. We used Ti-6Al-4V Titanium alloy samples since it is the most prevalent material used in dental implants. The samples underwent an extensive polishing procedure to ensure that the surfaces were as smooth as possible, then were put through a hydrothermal etching process using .5M of NaOH at various hours in a furnace at 250 degrees Celsius. Thirty samples were split into groups of three and placed into the oven for 0, 2, 3, 4, 5, 6, 7, 8, 9, and 10 hours respectively. Through hydrothermal etching, a titanium oxide layer was

formed with nanopillar structures. SEM images on the samples showed that hours 6 through 8 created the most uniform nanopillar structured surface which should indicate that these samples will be the most successful in creating a strong antibacterial surface on the material. When the samples were hydrothermally etched in the furnace outside of these time lengths the SEM images showed that the nanopillar structures were not uniform on the surface of the samples which could create a higher possibility of bacterial growth. The samples then underwent bacterial testing using *S. aureus*, *Phedomonas*, and *E. coli*. Following bacterial testing, the samples underwent IVIS scanning and went through SEM again to confirm which time length created the best antibacterial surface on the material used.

111

Name: LeBlanc, Lauren

Major: Psychology

Faculty Advisor: Cliff McKinney, Psychology

Co-Author(s): Alli Grace Story

Indirect Effects of Feminist Ideology on Body Appreciation via Empowerment

Previous research has shown that body image is a prevalent issue that negatively impacts men and women. However, less research has examined the effects of feminism and empowerment on body image. Thus, the current study seeks to examine how feminism indirectly affects body appreciation via empowerment in emerging adults. Hypothesis 1 stated that feminism would be positively associated with body appreciation. Hypothesis 2 stated that empowerment would be positively associated with body appreciation. Hypothesis 3 stated that feminism would indirectly affect body appreciation via empowerment. Researchers measured feminism, empowerment, and body image in participants an online survey. For women, results indicated a significant direct effect of feminist ideology on activism, $\beta = .18$, $p < .01$, optimism, $\beta = .11$, $p = .01$, and righteous anger, $\beta = -.10$, $p = .03$. Results for women also indicated a significant direct effect of empowerment esteem, $\beta = .50$, $p < .01$, powerlessness, $\beta = -.16$, $p < .01$, activism, $\beta = -.09$, $p < .01$, optimism, $\beta = .09$, $p = .03$, and anger, $\beta = .15$, $p < .01$, on body appreciation. Results found no significant indirect effects in women. For men, results indicated a significant direct effect of feminist ideology on esteem, $\beta = -.11$, $p = .04$, powerlessness, $\beta = .16$, $p < .001$, and optimism, $\beta = -.12$, $p = .02$. Additionally, results indicated a significant direct effect of empowerment esteem, $\beta = .49$, $p < .01$, and powerlessness, $\beta = -.18$, $p < .01$, on body appreciation. Results for men also found a significant indirect effect of feminism on body appreciation via empowerment esteem and powerlessness, $\beta = -.09$, $p < .05$.

29

Name: Lindsey, Kyle

Major: Aerospace Engineering

Faculty Advisor: Matthew Priddy, Mechanical Engineering

Funding: Center for Advanced Vehicular Systems

Use of FDM AM of 316L Stainless Steel for Spaceflight Vehicles Adapted from NASA's L-PBF Standard (MSFC-STD-3716)

Conventional metal-based additive manufacturing (AM), such as laser powder bed fusion (L-PBF), has paved the way for cost and time effective rapid prototyping and one-off production. However, these types of additive manufacturing have very large initial costs, with machines often costing as much as 500,000 USD. These large initial costs have contributed to the lack of large-scale adoption of metal AM via L-PBF. However, polymer based Fused Deposition Modeling (FDM) has become very common due to its low cost of entry (as low as 250 USD). With the advent of metal filaments for FDM 3D printers, the potential cost of metal AM has drastically decreased. This study compares printing UltraFuse 316L Metal 3D filament on both the Creality Ender 3 V2 and the MakerBot Method X to L-PBF in an effort create a material standard for use of FDM to construct structural spaceflight components. The use of FDM for Spaceflight Structures will be evaluated per Marshal Space Flight Center's L-PBF standards (MSFC-STD-3716). To analyze the part performance, mechanical and density testing were performed on tensile specimens printed with varying print settings and compared with parts produced by the L-PBF AM process. The MakerBot Method X printed consistent, fully dense specimens that have Young's moduli and ultimate tensile strengths like that of 316L L-PBF stainless steel. Meanwhile, the specimens printed on the Creality Ender 3 v2 displayed inferior in mechanical properties and specimen density. This work will create a material standard validating the of FDM prints for structures on spaceflight vehicles.

209

Name: Little, Emily

Major: Food Science, Nutrition, & Health Promotion

Faculty Advisor: Xue Zhang, Food Science, Nutrition, and Health Promotion

Co-Author(s): Wesley Schilling, Sawyer Wyatt Smith, Louis Chatham, Macie Bishop, Corbin Fornes, Morgan Mosby

Funding: College of Agriculture and Life Sciences URSP

Effect of Xanthan Gum on Rheological and Sensory Properties of Gluten-Free Chicken Nugget Batters

With an increase of celiac disease amongst western countries and a greater health-conscious push, demand for gluten-free products has risen. The goal of this study was to determine the effect of xanthan gum (XG) on the rheological and sensory properties of various gluten-free chicken nugget batters in comparison to a control batter containing gluten. A 3 × 4 factorial arrangement within a randomized complete block (RCB) design with 3 replications was used to evaluate the viscosity of batters as affected by the type of flour (gluten-containing All-Purpose flour (AF), gluten-free Rice Flour (RF) and Chickpea Flour (CF)) and % XG (0%, 0.05%, 0.075%, and 0.1%). The addition of 0.075% and 0.1% XG increased ($P < 0.05$) the viscosity of AF and CF batters but not ($P > 0.05$) the RF batters. The addition of 0.05% XG increased ($P < 0.05$) the viscosity of AF batters only. Therefore, 0.075% XG was included in the batter coatings for fried chicken nuggets for sensory analysis. A 3 × 2 factorial arrangement within a RCB design with 3 replications was used to evaluate the effects of flour (AF, RF, and CF) and % XG (0% and 0.075%) on the sensory descriptors of fried chicken nuggets coated with batters. There was no flour × XG interaction effect ($P < 0.05$) on any attributes evaluated. When averaged over XG concentrations, gluten-free RF and CF batter-coated nuggets did not differ ($P < 0.05$) from AF nuggets in fracturability, overall juiciness, coating crunchiness, mouthcoating profile, brothy, and basic tastes including chickeny/meaty, umami, and saltiness. The CF nuggets were less ($P < 0.05$) springy, more ($P < 0.05$) earthy, beany and nutty than AF nuggets. In conclusion, gluten-free RF and CF batters may be used as alternatives to AF batters. Future research will determine consumer acceptability of RF and CF chicken nugget batters.

112

Name: Mahaffey, Katy

Major: Psychology

Faculty Advisor: Danielle Nadorff, Psychology

Co-Author(s): Maia McLin

The Impact of Depressive Symptoms on Academic Performance in Custodial Grandchildren

Studies have shown that mood affects academic performance in children (Lundy et al., 2010). Lesser known is the effect that mood has on different competencies and skills that relate to academic achievement, especially in children raised by grandparents. Several studies report children raised by grandparents have more adverse mental health and academic outcomes than children raised by their biological parents (Yafeng et al., 2021). More specifically, one study found that children who are raised by their grandparents are more likely to experience heightened emotional and behavioral problems, which may follow them into the classroom (Li et al., 2019). Another study suggested that the only area in which children raised by grandparents fall short is academic performance (Solomon & Marx, 1995). The current study hypothesized that more reported depressive symptoms would negatively correlate with self-control, academic self-efficacy, persistence, and mastery orientation in children raised by grandparents. Participants (323 caregiving grandparents, m age=55.66) were recruited nationwide via Qualtrics Panel Service. Participants completed Angold & Costello Mood and Feelings Questionnaire (1987) and the Child Trends Survey (Scarupa & Child Trends, 2014) according to how they perceived their grandchild's mood and academic performance. The study found that there was a significant negative correlation between increased reported depressive symptoms and self-control ($r = -.192$, $p < .01$), persistence ($r = -.137$, $p < .05$), and mastery orientation ($r = -.165$, $p < .05$). Self-efficacy though, showed no significant correlation with depressive symptoms ($r = -.115$, $p > .05$). Based on these findings, depressive symptoms are likely to correspond to reduced self-control, persistence, and mastery orientation in children raised by grandparents. It may be helpful to determine if improving self-control, persistence, and mastery orientation can reduce depressive symptoms among children raised by grandparents.

210

Name: Mann, Aysha

Major: Biomedical Engineering

Faculty Advisor: Amirtaha Taebi, Agricultural and Biological Engineering

Cardiac time interval estimation based on seismocardiography

Cardiac time intervals (CTIs) are important parameters for assessing cardiac function and can be measured using non-invasive methods such as electrocardiography (ECG) and seismocardiography (SCG). It is widely accepted that SCG signals, when measured from various locations on the chest surface, exhibit distinct temporal and spectral characteristics. In that regard, the goal of this study was to determine the effect of the SCG measurement location on estimating SCG-based CTIs. For this purpose, ECG, SCG, and phonocardiography (PCG) signals were acquired from fourteen healthy adult subjects, both male and female (Age: 23.5 ± 5.16 years old). For SCG, three tri-axial accelerometers were attached on the top, middle, and bottom of the sternum, and only the dorsoventral components of the signals were analyzed. Using Pan-Tompkin's algorithm, ECG R peaks and their temporal indices were found. Then, a custom-built algorithm in MATLAB was developed to estimate heart rate (HR) from ECG (HRECG), PCG (HRPCG), and SCG (HRSCG) signals. Furthermore, SCG fiducial points and CTIs were defined based on the literature and estimated from the SCG signals recorded from different sternal locations. These fiducial points and CTIs include the temporal indices of the mitral valve opening and closure, aortic valve opening and closure, R-R interval, pre-ejection period, left ventricular ejection time, electromechanical systole, and electromechanical delay. Results showed that the R2 values between HRECG and HRSCG and SCG-based CTIs varied with the SCG

measurement locations. In conclusion, these results highlighted the importance of establishing consistent research and clinical protocols for reporting data based on SCG. This work also calls for further investigation on comparing estimated CTIs with gold-standard methods such as echocardiography and 4D cardiac computed tomography. This will determine the SCG measurement location that provides the most accurate CTI estimations which in turn can improve the accuracy of SCG-based cardiovascular disease diagnosis algorithms.

113

Name: Mann, Hannah

Major: Human Development & Family Science

Faculty Advisor: JuYoung Lee, Fashion Design and Merchandising

Co-Author(s): Madi Gray, Ansley Clark, Kendra Montgomery

How an individual's mood and self-image affect the style and fit of clothes they choose to wear

The way a person feels in and about their clothes is a relevant phenomenon in that it impacts social behavior and social life. How we feel is often expressed by what we wear. The relationship between mental health and clothes worn is extensive and draws on many distinct components of the human experience, including tradition, cognition, symbolism, and customs. The connection between clothing and mental health also touches upon notions of self and identity including self-expression, and cultural identity. The current study was intended to explore how mood and self-image affect the clothes that a person wears. The purpose of this research is to understand how an individual's mood and self-image affect the process of determining daily fashion choices. It was hypothesized that mood and self-image will have an impact on daily fashion choices including the style and fit of clothes. Most studies are focused on the female population because the relation between self-image and fashion is a higher priority to this specific group. In this study, the authors utilized Qualtrics to conduct an online survey to Women ranging from 18-80 years old to explore how a person's mood and self-image affect the style and fit of clothes they choose to wear each day. Our hypothesis was tested using correlation analysis to test the variables mood and self-image and compare it to their choice of style and fit for clothing.

114

Name: Martin, Abigail

Major: Psychology

Faculty Advisor: Cliff McKinney, Psychology

Emotion Dysregulations Influence on PTSD Symptoms and Social Competence

Childhood trauma exposure is associated with higher levels of emotion dysregulation and impaired social functioning (Dvir et al., 2022). Individuals with childhood trauma have been shown to display higher levels of PTSD symptoms and under-utilize effective emotion regulation (ER) strategies (McLean & Foa, 2016). Effective ER strategies linked to lower PTSD severity include acceptance, cognitive reappraisal, and problem-solving (Dvir et al., 2022). Additionally, emerging adults displaying higher levels of PTSD symptoms have shown lower social competency (Dvir et al., 2022). The present study examines how emotion dysregulation moderates the relation between current PTSD symptoms and social competency while controlling for adverse childhood experiences (ACEs). Specifically, it was hypothesized that emotion dysregulation would exacerbate the influence of PTSD symptoms on social competency. Participants (N = 736) completed four questionnaires: Adverse Childhood Experiences (ACEs), PTSD Checklist for DSM-5 (PCL5), Difficulties in Emotion Regulation Scale (DERS), and the Interpersonal Competence Questionnaire (ICQ). The findings indicated that the main effect between PTSD symptoms and social competency was not significant, $\beta = -.08$, $p = .12$, whereas the main effect between emotion dysregulation and social competency was significant, $\beta = -.42$, $p < .001$. There was a significant interaction effect of emotion dysregulation and PTSD symptoms on social competencies, $\beta = .16$, $p < .001$. Among emerging adults who reported higher emotion dysregulation, PTSD symptoms did not associate with social competencies, consistent with the non-significant main effect reported above. Among those with lower emotion dysregulation, PTSD symptoms shared a negative relation with social competencies, contrary to the overall main effect above. Higher emotion dysregulation appeared to flatten, rather than exacerbate, the effect of PTSD symptoms on social competence. These findings suggest the effect of PTSD on social competence depends on levels of emotion dysregulation. Individuals with higher levels of emotion dysregulation may benefit from targeted interventions to improve social functioning.

211

Name: Martinez Diaz, Wilson

Major: Aerospace Engineering

Faculty Advisor: Matthew Priddy, Mechanical Engineering

Co-Author(s): David Failla

Modular Framework for Finite Element Analysis of Lattice Structures and Application to Post-Lumbar Interbody Fusion Cage Design

Recent advances in additive manufacturing (AM) equipment have enabled the development of complex geometries, such as lattice

structures (LS), which were not previously possible with subtractive manufacturing techniques. Lattice structures have a high strength-to-weight ratio and can be customized for use in various industries, including automotive, medical, and architectural. However, the current methodology for conducting mechanical finite element (FE) simulations on lattice structures is labor-intensive and strenuous. To address this, this research utilizes a developed modular framework that can perform FE simulations on any lattice structure, regardless of varying strut sizes and custom parameters. The framework was used to simulate compression tests on a Post-Lumbar Interbody Fusion Cage (PLIF), a spinal implant used in surgical procedures to treat various spinal conditions. The PLIF cage was designed with a complex geometry, including tool holes, using three lattice structures (cube, cylindrical, and honeycomb) at varying levels of porosity. The most suitable lattice structure was selected, and a calibrated material model was applied to the implant design. The framework was then used to numerically simulate the final implant design and analyze its mechanical characteristics under compression. This study has significant implications for the medical sector as it presents a more efficient and precise method for developing and testing lattice-based spinal implants, which could lead to improved patient outcomes.

212

Name: Masaitis, Malori

Major: Animal and Dairy Science

Faculty Advisor: Brian Rude, Animal and Dairy Sciences

Funding: College of Agriculture and Life Sciences URSP

Evaluation of Angus calves born to early or late winter hair coat shedding dams for nutrient digestibility and N retention

The objective of this experiment was to investigate the nutrient digestibility and N retention of Angus calves born to cows that, on average, shed winter hair coats early, compared to calves from cows that shed later. Newly weaned, purebred Angus bull calves (early; n = 6, late; n = 6) were housed in 12 metabolism crates for 10 d. Prior to the trial, calves had a 14 d acclimation period to a 14% CP textured feed (CPC 14% Developer, CPC Commodities, Fountain Run, KY) and offered ad libitum bermudagrass (*Cynodon dactylon*) hay and water. After 3 d crate acclimation period, urine, feces, orts, and hay samples were collected for 7 d. Laboratory analysis included dry matter (DM), organic matter (OM), and Kjeldahl N (CP). Data were analyzed using the GLM procedure of SAS 9.4 in a completely randomized design with calf as the experimental unit. Significant ($P \leq 0.05$) means were separated using Fischer's protected LSD. The model for intake included average daily DM and OM (kg/d) and adjusted by body weight (%BW). The N retention model included: N retained (g/d), N retained/N consumed (%), and N retained/DM intake (%). There were no differences ($P > 0.05$) between early or late calves for DM intake (5.502 ± 0.2774 kg/d; 2.251 ± 0.1247 %BW; respectively), or OM intake (5.199 ± 0.2591 kg/d; 2.128 ± 0.1166 %BW; respectively). There were no differences in N retention in either group of calves (3.686 ± 2.0242 g/d; 4.366 ± 2.3964 %; 0.064 ± 0.0355 ; respectively). In conclusion, further investigation into the relationship between dams hair shedding ability and calf nutrient digestibility and N retention is needed.

115

Name: May, Grace

Major: Human Development & Family Science

Faculty Advisor: Lori Elmore-Staton, School of Human Sciences

Co-Author(s): Alisha Hardman

Funding: Trauma-Informed Parenting and Professional Strategies Program

Evaluation of Knowledge and Skills Gained Through Emotion Regulation Parenting Toolkits for Mississippi Families

According to the U.S. Department of Health and Human Services, 588,229 American children experienced child maltreatment in 2021. The Protect and Connect Extension program at Mississippi State University seeks to prevent child maltreatment by providing research-based parent education to Mississippi families. The Protect and Connect program is a novel approach to parent education, patterned after a subscription box model where parents are mailed a series of three toolkits. The Emotion Regulation toolkit contained items focused on healthy family emotion regulation strategies. This study examined the effectiveness of the Emotion Regulation toolkit in promoting parental knowledge and skills across six domains: (1) nurturing parenting practices, (2) safety threats and protection strategies, (3) positive guidance (i.e., discipline) strategies, (4) family stress and conflict management strategies, (5) practices to promote child development, and (6) co-parenting strategies. The sample included 1403 Mississippi families with children aged 0-18 recruited by social media and fliers. The data reflects parents who completed the Emotion Regulation toolkit evaluations ($n = 506$). The evaluation method used was a modified version of the MSU Extension Standardized Evaluation Survey. Participants answered questions on a 1-5 scale ranging from strongly disagree (1) to strongly agree (5), with higher scores representing perception of gains. Evaluation questions began with the phrases, "I increased my knowledge of" or, "I learned new skills related to" in relation to all of the six aforementioned domains. Data suggest that the Emotion Regulation toolkit was effective in promoting gains in knowledge and skills across all six domains, with the highest mean indicated for increasing knowledge of positive guidance strategies ($M = 4.50$; $SD = .721$) and the lowest mean related to how to co-parent effectively ($M = 4.31$; $SD = .897$). Overall, these preliminary findings indicate the Emotion Regulation toolkit effectively increased parenting skills.

213

Name: Mays, Adriana

Major: Biological Sciences

Faculty Advisor: Sungkwang Mun, Center for Advanced Vehicular System

Co-Author(s): Anna Landrum

Microstructural Observation on Antibacterial Surfaces of Biological Materials and Etched Ti-6Al-4V

Antibacterial surfaces for *Staphylococcus aureus* (*S. aureus*) were developed from hydrothermal etching on the surface of Ti-6Al-4V (titanium alloy) with regard to natural materials. Preventing infection and biofilm formation is a critical goal in all medical procedures. Many treatments such as antibiotics and coating techniques have reduced the risk of infections. However, in processes where bacteria are constantly proliferating, such as dental and bone implant procedures, infection can be as high as 3%. Interestingly, natural materials such as plants' roots rarely develop infection or biofilm despite plants' roots being constantly exposed to a wide range of bacteria underground. Inspired by those natural materials' nanotextures, we examined surfaces of natural materials (plants' roots and fish scales) using the Scanning Electron Microscope (SEM) and observed nanotextures that could be effective in preventing bacterial adhesions. We found varying depths of micropillars in plant roots and interconnecting channels were often found in fish scales. The pattern of these pillars and channels were uniform across the surface. We also developed nanopillars on titanium alloy using hydrothermal etching and analyzed its antibacterial properties. Bacterial testing on titanium alloy was conducted, in which the chemically etched titanium alloy was placed in an environment with *S. aureus*, where developed biofilm was observed. The In Vivo Imaging System was used to evaluate bacterial attachments on the surface, and its results showed that some etched surfaces hindered bacterial adherence while others attracted more bacterial adherence. Under the SEM, we found that both surfaces presented strong, sharp nanopillars; however, the surfaces that demonstrated antibacterial properties had nanopillars with larger angles perpendicular to the surface compared to surfaces that attracted bacteria. Future plans include performing bacterial testing for the plant roots and fish scales to determine their antibacterial properties against *S. aureus* and other common bacteria like *Escherichia coli* and *Pseudomonas*.

49

Name: McArthur, Kathryn

Major: Music Education

Faculty Advisor: Sheri Falcone, Music

An Exploration of Mozart's Clarinet Concerto K. 622 in A Major

Classical composer Wolfgang Amadeus Mozart (1756-1791) composed his only concerto for clarinet shortly before his death. Written for his friend Anton Stadler to be originally performed on the basset clarinet, Mozart's Clarinet Concerto K. 622 is considered one of the first major works written for the clarinet during this time. The virtuosic writing blends flowing lyrical passages fueled by melancholic undertones with running flourishes of scales and arpeggios that highlight the technical ability of the performer. The movement's structure, a five-part Rondo form with a coda, allows the performer to showcase the ability to transition between vibrant and challenging scale like runs to a more mysterious and haunting tonality. This piece is attainable by those with more advanced skills as it requires an indepth understanding of the theoretical aspects as well as the technical and musical ability to shape in it a way that stays true to Mozart's original intention. My analysis of the third movement of this work will demonstrate both the advanced technical demands placed upon the performer with the full range of the clarinet being showcased extensively as well as an understanding of the musical elements that make this work tonally and thematically complex. This presentation examines various elements of historical context, provides an analysis of the piece, and offers interpretive information with the goal of providing an insight into one of the most well-known and beloved clarinet concertos.

116

Name: McClinton, Cameron

Major: Psychology

Faculty Advisor: Carolyn Adams-Price, Psychology

Co-Author(s): Darby Mackenstadt

The Influence of Work Status on the Mental Health of Older Adults in Urban Areas Compared to Rural Areas

There are various socioeconomic factors that play a role in influencing the mental health of individuals, including work status. Utilizing the Center of Epidemiological Studies Depression Scale (CESD-R) and the Perceived Stress Scale (PSS), the current study examines the relationship between specific levels of work status and the mental health of older adults in urban areas compared to rural areas. The sample includes 266 participants who were primarily Caucasian women (95.5% women, 88.3% Caucasian), aged 40 to 84 ($M = 59.67$), that were either employed full-time, part-time, retired, or unemployed. In SPSS, a split file was created to compare 148 urban adults to 118 rural adults using a one-way ANOVA. In urban areas, the one-way ANOVA yielded a significant result for the influence of work status between groups on CESDR scores $F(3, 144) = 5.60, p < .05$ and PSS scores $F(3, 144) = 5.28, p < .05$. In rural areas, the one-way ANOVA also yielded a significant result for work status between groups on CESDR scores $F(3, 114) = 3.34, p < .05$ and PSS scores

$F(3,114) = 3.46, p < .05$. In follow-up analyses, Tukey HSD post hoc comparisons revealed that various groups were significantly different on mental health ratings in both the rural and urban groups. Within the comparisons, it was revealed that retired individuals often differed significantly from the other groups in both rural and urban areas. As expected, retired individuals had significantly lower CESDR and PSS scores than unemployed individuals, regardless of location. This outcome can possibly be attributed to the universal sense of security that older adults have when they are retired opposed to the instability that comes with being unemployed. These results highlight the growing importance of creating or expanding jobs and financial opportunities for older adults everywhere.

214

Name: McKinnon, Kendall

Major: Biological Sciences

Faculty Advisor: Russell Carr, Comparative Biomedical Sciences

Inhibition and Recovery of Cholinesterase Activity in Juvenile Rat Brain and Serum following Acute Exposure to a Nerve Agent Surrogate

The most toxic chemical warfare agents are organophosphates (OP), commonly referred to as nerve agents. These compounds exert toxicity through inhibition of acetylcholinesterase (AChE), leading to accumulation of neurotransmitter acetylcholine, which induces hyperactivity in the peripheral and central cholinergic system with death resulting from loss of respiratory function. Exposure can produce prolonged repetitive seizures and status epilepticus, a medical condition causing high morbidity. While frequently considered a military threat, nerve agents were used to target civilian populations, such as Japan in the 1990s and Syria in the 2010s. A component of this population thought to be most susceptible is the pediatric population. However, nerve agent effects on juveniles have not been greatly studied. In majority of studies involving OP nerve agent or surrogate exposure to preclinical models, exposure has been at lethal dosages, accompanied by co-administration of therapeutics against OP-induced lethality (i.e., atropine and 2-PAM). However, less is known about persistent effects of high sub-lethal OP exposures. In this study, the sarin surrogate NIMP (nitrophenyl isopropyl methylphosphonate) was used to investigate sub-lethal effects of nerve agent exposure. Male and female 16-day old rats, exposed subcutaneously to either the vehicle multisol or 0.175 mg/kg NIMP, were sacrificed at 4 h and 1, 4, 7, and 14 days post-exposure. The NIMP treated rats exhibited episodic seizure-like signs. Brain AChE and serum ChE activities were determined. There was significant inhibition of serum ChE at 4 h (80%) with recovery at 1 day (59%) and 4 days (17%). Recovery to normal activity was evident by 7 days. Brain AChE was also inhibited at 4 h (65%), 1 day (57%), 4 days (31%) and 7 days (23%) with recovery to normal activity by 14 days. These data suggest NIMP exposure can elicit episodic seizure-like signs at moderate levels of brain AChE inhibition.

215

Name: McKnight, Madeline

Major: Animal and Dairy Science

Faculty Advisor: W. Isaac Jumper, Pathobiology and Population Medicine, College of Veterinary Medicine

Co-Author(s): Juan F. Cordero, Jason R. Russell, David R. Smith

Describing the Consumption of Chlortetracycline-Containing Mineral Offered Free-Choice to Commercial Beef Cows on Pasture

Beef cattle production systems depend on forage to provide most nutrients, however, mineral supplementation is often needed. Beef cattle producers often provide mineral supplementation in a free choice manner. Variation in mineral intake creates problems delivering medication such as chlortetracycline (CTC), which is aimed to mitigate the risk of bovine anaplasmosis in beef herds. The objective of the present study was to describe the consumption patterns of a granular, CTC-containing supplement and evaluate factors contributing to consumption variability. A total of 103 nonlactating, pregnant, crossbred cows were assigned to 1 of 3 pastures, each equipped with a portable, self-contained individual feeding unit (SmartFeed; C-Lock Inc.). SmartFeed units were used to record individual animal supplement intake and frequency. Cows were offered dried distillers' grains for 27 days of acclimation (mean intake of 0.29 kg/day) before transition to a commercially available granular mineral containing CTC on day 0 for 46 days. Cow intake and unit visit frequency data was analyzed using a general linear model (PROC GLM) and differences evaluated using Least Squared Means. The mean number of consecutive days a cow did or did not consume mineral was 1.8 and 5.6 days, respectively. As cow age increased, visits to the feeding unit decreased and total supplement consumption also decreased ($P < 0.01$). Mean supplement consumption was 40.5 g/cow/day, or 0.25 g CTC/cow/day. According to label instructions, each cow should consume a total of 5.2 kg of mineral over 46 days. This total amount of mineral would provide 32.2g of CTC according to label CTC concentration. Only 1.9% (2/103) of cows consumed at least 5.2 kg of mineral over the 46-day period. Results of this study indicate providing a granular supplement containing CTC free choice is not an effective method of ensuring cattle consume a daily label dose of CTC.

117

Name: Mclemore, Jennifer

Major: Psychology

University: MSU-Meridian

Faculty Advisor: Vicki Gier, Arts & Sciences, Psychology, MSU-Meridian

Co-Author(s): David Kreiner, Rona del Rosa

The Effect of Significant Weight Loss/Gain on Face Recognition in a Long-Term Missing Person's Alert

Our ability to recognize faces applies to identifying ways to improve the effectiveness of photos in missing person alerts such as AMBER or Silver Alerts. Previous research using mock AMBER Alerts, indicated better recognition for a missing child if the appearance of the child's face in a photo seen in the alert matched the child's appearance when participants attempted to recognize whether they had seen the child before (e.g., dirty and bruised vs. clean; Gier & Kreiner, 2009a; & Gier & Kreiner, 2009b). Our current students included 732 undergraduates who participated in the study in Qualtrics. We investigated a similar scenario in adults as did the prior mock AMBER Alert studies (Gier & Kreiner, 2009a; Gier & Kreiner, 2009b). In the current study, the ability to recognize a person who was a long-term missing person and who had either gained or lost a significant amount of weight (120 lbs). This scenario is quite possible with weight loss surgery procedures on the rise, as well as multiple weight loss programs and weight loss prescriptions promoted by the media. In our current study, we manipulated appearance in the alert (obese/normal weight) and appearance in recognition photos (obese/normal weight in a factorial design. No significant differences were found between the FAT Phobia Scale, EAT Scale, and Compassion for Others Scale. Like the results found in mock AMBER Alerts, we hypothesized that recognition of the missing woman would be greater when appearance in the alert matched appearance at recognition. Our hypotheses were supported by showing poor recognition of the missing lady's face in the Before/After, and After/Before; however, confidence levels between conditions were not supported. The results could be important for those who are long-term missing people and whose appearance has dramatically changed because of significant weight loss or gain.

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Name: Mechatto, Abigail

Major: Microbiology

University: Louisiana State University

Faculty Advisor: Michael Stout, Entomology, LSU

Funding: Undergraduate Research Grant from the Discover Undergraduate Research Program at LSU

The Relationship Between Deterrence and Toxicity of Plant Secondary Metabolites Against Fall Armyworms

Secondary metabolites are nonessential compounds found in all organisms that provide selective advantages by mediating ecological interactions with other organisms. This research explores the mode of action of various secondary metabolites naturally found in plants. There are numerous compounds that are currently being tested for deterrence and toxicity against the insect *Spodoptera frugiperda* (fall armyworm), including caffeine, ferulic acid, p-coumaric acid and gramine. During experiments, a calculated realistic amount of each compound is put on leaf disks from soybean (*Glycine max*) plants, and the effects on the behavior and physiology of fall armyworm larvae are analyzed by measuring both area of plant eaten and the growth (weight gain) of the insect. Additional experiments will soon begin incorporating the compounds into insect diet over a longer period, as well as experiments to compare the behavioral and post-ingestive effects when plants other than soybean are used. These experiments test the hypothesis that insects will be most deterred by compounds that are deleterious [or have negative effects on] to the growth of insects. Research on the effects of natural plant metabolites on insects helps to explain the range of plants that insects are known to ingest. This research is relevant in many ways, particularly for the topic of pesticides. A better understanding of the effects of these secondary metabolites may lead to development of natural insecticides to protect plants from insect consumption.

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Name: Middleton, Allie

Major: Fashion Design & Merchandising

Faculty Advisor: Tommy Phillips, Human Sciences

Co-Author(s): Anna Beth Billingsley, Martha Anne Dyer, Gabby Leake

Is Knowledge of Working Conditions in the Fashion Industry Related to How Consumers Respond to the Market?

The overall purpose of this study is to explore whether consumers consider shopping with companies that have poor labor conditions. The proposed study examines whether consumers that are aware of labor conditions make socially ethical buying decisions. The hypothesis of the research is that individuals who are aware of the labor conditions in the fashion industry are more socially responsible than those who are unaware of the poor labor conditions. The two groups in the mean comparison are: Group A, consumers that are aware of labor conditions in the fashion industry, and Group B, consumers that are unaware of labor conditions in the fashion industry. The independent variable in the research is consumer awareness of labor conditions in the fashion industry. The dependent variable is

the purchasing intention of consumers. Lastly, the moderating factor is consumer perception. The purchasing behavior of consumers for products is affected by the level of awareness of labor conditions in the fashion industry. This research study explored consumer purchase intentions, consumer purchase behavior, and consumer awareness of labor conditions through an online survey using Qualtrics. Consumer awareness is measured on a 5-point numerical rating scale. The study measures purchase intentions on a 3-point scale. Lastly, the survey measures the social responsibility of consumers on a 5-point numerical rating scale. The construct measure is a survey-related correlation used to assess consumer awareness of labor conditions, consumer purchasing intentions, and consumer purchasing behaviors. Correlational analysis was conducted to test the hypothesis, "individuals who are aware of labor conditions in the fashion industry are more socially responsible purchasing choices than those who are unaware of the poor labor conditions."

217

Name: Miller, Hannah

Major: Biochemistry

Faculty Advisor: Richard Baird, Biochemistry, Molecular Biology, Entomology, and Plant Pathology

Funding: Shackouls Honors College Research Fellowship

Temporal Study of Reactive Oxygen Species in Two Soybean Cultivars

Reactive oxygen species (ROS) are highly reactive molecules that are generated as byproducts of cellular metabolism. These compounds exist in all forms of life and are especially essential to the metabolism in plants such as soybeans (*Glycine max* (L.) Merr.). ROS are important in cellular signaling and the maintenance of homeostasis under normal plant growth, but stress and other epigenetic factors can disturb the ROS/antioxidant ratio resulting in excessive oxidation of cellular components thus causing membrane damage and DNA degradation/dysfunction. This deterioration can increase plant susceptibility to pathogens, ultimately resulting in crop loss. The goal of this study was to analyze the impact various environmental conditions have on the levels of ROS in two cultivars of soybeans across time. In conjunction with Dr. Reddy's soybean growth study which assessed the growth of the two soybean cultivars, one of which is classified as heat tolerant, in growth chambers with varying conditions (temperature, water and CO₂ variations), we conducted a secondary temporal study by collecting leaf tissue across three dates: pre-treatment, 3-weeks following the introduction of the treatment, and before senescence of the plants. Key oxidative species that cause cellular damage are transient in nature and cannot be accurately measured, but intermediates of these ROS can be assayed with their respective ROS scavengers to determine the degree of ROS activity. To measure the ROS levels in the two cultivars, four different assays were performed: Glutathione Reductase, Glutathione Peroxidase, Lipid Peroxidation, and Hydrogen Peroxide. From these data, disease resistance in soybean could then be controlled by breeding efforts to develop soybean cultivars with greater tolerance to the drought and higher temperatures that initiate oxidative damage which is especially crucial considering current and future changes in climate. Resultant data and statistical analyses are presented.

119

Name: Miller, Julie Anne

Major: Psychology

Faculty Advisor: Hilary L. DeShong, Psychology

Co-Author(s): Kren Kelley, Courtney K. Mason

Funding: Shackouls Honors College Research Fellowship

Examining childhood risk and protective factors and adult attachment styles in relation to borderline personality disorder and depressive symptoms

Depression and borderline personality disorder (BPD) are often co-morbid mental health conditions associated with maladaptive relationship attachment styles. Previous research suggests heightened emotional sensitivity and parental invalidation in childhood predict symptoms of BPD but not depression in adulthood. Investigating how childhood risk factors relate to maladaptive attachment styles and subsequent symptoms of depression and BPD in adulthood may provide insight into potential transdiagnostic prevention and intervention strategies. The current study investigated the potential mediating effects of childhood risk factors and maladaptive attachment styles on the presence of BPD and depressive symptoms. Student participants (N = 403) completed an online self-report survey. Two serial sequential mediations were conducted in AMOS 28, in which depression and BPD were the two outcomes assessed in separate models. The final models accounted for 51.10% of the variance in BPD symptoms and 30.20% of the variance in depression. Childhood emotional sensitivity, parental invalidation, and adult maladaptive attachment styles were significant positive predictors of BPD and depression. Parental validation was a unique negative predictor of BPD symptoms. As hypothesized, parental validation emerged as a protective pathway for BPD; however, this was not observed for depression. Results suggest growing up in a validating environment may reduce the risk of developing BPD while it does not seem to impact the presentation of depression. These results suggest parental validation could prevent externalizing pathology more so than internalizing pathology. Future research may benefit from identifying internal and external childhood risk factors that differentially contribute to the development of depressive symptoms in adulthood in order to develop potential childhood prevention and intervention strategies.

120

Name: Mixon, Grace

Major: Fashion Design & Merchandising

Faculty Advisor: Juyoung Lee, School of Human Sciences

Co-Author(s): Beth Boyd, Aubrey Buford, Jahliyah Jordan, Ashley Wingo

The Impact of New Technology Developments in Retail

In recent years, the rate at which individuals participate in online shopping has greatly increased. The purpose of this study is to find the relationship between online shopping technologies and repetitive shopping habits. This study hopes to find out what makes a customer make a repeated purchase at a company based on website accessibility, product availability, and customer service. In this study, Qualtrics will be utilized to conduct an online survey to 18-30-year-olds about customer retention in online shopping. A 5-point Likert scale will be utilized to survey the participants about their online shopping experiences. The scale will range from 'Not Likely to Extremely Likely.' Consumers are asked to think back to their most recent online purchase in order to recall more accurate results; customers will answer questions about the impact discounts, pop-ups, and ability to navigate a company's website can affect their perspective on the accessibility of the company website which results in the intention to repeat shopping. Consumers will next have the opportunity to express the company's products available when they recently made an online purchase. Such questions ranged from asking how likely they were able to find products they were looking for to would that customer return back to the website to see other products or will they wait for that specific product to come back in stock. To find more information that will bring answers to the question of what makes a customer repeat shopping, responses will be given by consumers about the different forms of customer service they prefer, how often customer service is utilized, and how long the consumer will wait for a response. This gives a clearer understanding of the overall reasons why customers repeat their shopping or choose to take shopping elsewhere to another company.

218

Name: Morris, Kala

Major: Food Science, Nutrition, & Health Promotion

Faculty Advisor: Shecoya White, Food Science, Nutrition, and Health Promotion

Co-Author(s): Courtlone Glaspie, Ainsley Jessup

Funding: College of Agriculture and Life Sciences URSP

Effect of Air Fryer Technology on Convective Heat Transfer in Brownie Baking

Microbial contamination of brownies can be introduced through ingredients like flour, milk, cocoa powder, powdered sugar, or eggs. As the use of air fryers increases in households, it is important to validate cooking technologies. With a shift from traditional flours to non-traditional flours, cooking temperatures to inhibit microbial growth and survival also need to be validated. The objective of the study was to compare the heating rate in an air fryer for traditional brownies made with all-purpose flour to nontraditional brownies made with almond flour. Brownie batters were formulated with all-purpose and almond flour, in triplicate. Thermocouples were inserted into the top left, direct center, top right, and right center of the brownie batter. The pan was put into the air fryer set at 350°F. Temperatures were reported at 5 minute intervals (0, 5, 10, 15, 20) for each thermocouple. The brownies cooled for 15 minutes, then temperature, Aw, and pH were recorded. The average temperatures (pooled locations) of the all-purpose brownies were 21.5, 60.0, 81.8, 95.4, 102.5, and 72.7 °C at 0, 5, 10, 15, 20, and 35 min respectively. Almond flour brownies, average temperatures were 22.9, 67.8, 86.5, 98.8, 107.7, and 65.0 °C at 0, 5, 10, 15, 20, and 35 minutes. Overall, the almond flour brownies had a higher thermal penetration rate compared to all-purpose brownies using air-frying technology. The almond flour-brownies also exhibited higher Aw, meaning an increased risk for microbial growth. Since almond flour has different qualities than all-purpose flour, the microbial death times for potential pathogens could vary, product dependent. Due to recent food recalls related to contaminated flour, to help ensure safety of products using substitute flours, qualities like heat transfer need to be evaluated to determine impact on microbial growth and survival.

60

Name: Mosley, Nathan

Major: Biomedical Engineering

Faculty Advisor: Lourdes Cardozo-Gaibisso, English

Funding: ORED Undergraduate Research Program, B.R.I.D.G.E.S

Jugar y ser: Researching a novel immersive learning environment in a translanguaging and transmodal context

Although the population of Latinx Multilingual Learners (LML) continues to grow in the US; less than two percent of those in STEM careers identify as Latinx (National Center for Education Statistics, 2015). While educators and researchers have identified educational struggles faced by LML students, we have not seen consistent or sustained improvements in educational outcomes for LML students. This is because Latinx students face both linguistic and cultural hardships in STEM learning due to implicit bias and raciolinguistics ideologies (Flores & Rosa, 2015) built into our educational systems. Accordingly, researchers have argued for the need to build inclusive and culturally sustaining learning environments that engage underrepresented students with meaningful science learning experiences

(Harman et al., 2021). Our research posits that immersive learning environments such as serious educational games (SEGs) present innovative and ludic opportunities where LML can jugar y ser (play and be) within a new linguistic and transmodal landscape while increasing students' access to early science learning experiences (Hussein, Ow, Cheong, Thong, & Ebrahim, 2019). In this poster, we present a project that seeks to build equity into learning through the creation of an ambitious learning environment, Virtual Vet Middle Grade (VVMG), strategically designed to support LML in a translanguaging and transmodal context. (e.g. Garcia & Wei, 2014, Poza, 2017, Unsworth et al., 2022). The focus of the poster is to discuss (1) the design of VVMG as a learning environment within a translanguaging and transmodal context, and (2) our approach to designing a research study that analyzes the students' engagement and learning through the game. To this end, we focus on our approach to answer the research question: What translanguaging and transmodal patterns emerge across student interactions with VVMG, among their peers, and with their teachers?

30

Name: Mott, Mallory

Major: Aerospace Engineering

Faculty Advisor: Shreyas Narsipur, Aerospace Engineering

Co-Author(s): Marylynn Armstrong, Dawson Ozborn

Aerodynamic Analysis of Tubercled v. Traditional Airfoil Geometries with and Without Propeller Implementation

The effect of leading-edge tubercles and the propeller-wing interaction on aerodynamic efficiency across an airfoil during low Reynolds number flight were studied in this investigation through oil flow visualization and load cell data acquisition. This analysis was carried out through a range of angle of attacks from level flight to stall on the NACA 0012. A modular wing model was designed and fabricated for the Mississippi State University wind tunnel with a modular leading edge allowing for airfoil geometry variations and propeller integration. Following the testing of all configurations, the data was compared to results found by previous studies on tubercle geometries. The results explored individual benefits of the leading-edge tubercles and propeller-wing interaction in consideration of flow separation and the lift to drag ratio. This was due to the proposed interaction between the propeller tip vortices and the vortices induced in the tubercle troughs seen through flow visualization.

61

Name: Nail, Sofia

Major: Foreign Language

Faculty Advisor: Sol Pelaez, Classical and Modern Languages and Literatures

Legal Safety Risks in Informal Communities of Lima, Peru

This poster will be focused on characterizing modern-day *barriadas* and exploring the problems they face and why. *Barriadas* are informal communities on the edges of Lima, Peru that are founded by the general population and loosely regulated by the city government. These communities date back to the mid-1900s, but *barriadas* are still being constructed today. However, the remaining unclaimed land around the city is on the steep mountainsides around Lima, as opposed to the flatter land that had been available earlier. Although the residents do the majority of the development in these informal communities, the government does recognize the *barriadas* and in 1961 the *Ley de Barriadas* was passed. This law would shape the *barriadas*' development from then on. However, in the 50+ years since this law was passed, conditions in the *barriadas* have changed such that the regulations laid out by the *Ley de Barriadas* negatively affect the safety of these communities for the residents. Most of these changes are related to the mountainous terrain. Lima's *barriadas* are distinct from the formal communities in many ways and fulfill an important role in the city's housing, but the inflexibility of the legislation impacts their development. The *barriadas* and the people who found them could be greatly helped if Lima adapted the law to the present day conditions to eliminate the safety risks.

31

Name: Nanney, Andie

Major: Chemistry

Faculty Advisor: Amanda Patrick, Chemistry

Co-Author(s): Matthew Patrick

Reproducibility of drift gas modifier effects in ion mobility spectrometry of select small organic compounds

Ion mobility spectrometry (IMS) is an analytical technique which measures the time taken for gas-phase ions in an electric field to reach the end of a drift tube, recorded as the drift time. IMS instruments operate at a pressure where the ions traversing the drift tube experience collisions with background gases—often He or N₂--essentially producing drag, slowing them down. The shape of the ion determines how much drag it experiences, so the drift time of the ion is related to the ion's shape. IMS is attractive as an emerging technique for its ease of use, compatibility with mass spectrometry, and fast acquisition times (individual scans may be completed in ~30 ms, though scans are often repeated and averaged to increase the signal-to-noise ratio). Mobilities can be changed by deliberately

adding gaseous impurities, known as drift gas modifiers (DGMs). If DGMs can be paired with analytically challenging isomer separations, such that one isomer's drift time is more affected than the other, there is great promise for DGM use for small molecule isomer differentiation, where separations are especially difficult. Previous research from a group using a custom-built instrument has suggested certain DGMs may provide such selectivity improvements. However, for widespread analytical adoption and method development, it is critical that (1) these results are highly reproducible and (2) that similar results can be obtained on commercially available instrumentation that can be more widely accessible to analytical laboratories for routine use. Reported are some results of an ongoing project to reproduce the findings in the literature and to extend this work by investigating the inter-day and inter-user reproducibility of drift time shifts on a commercially available instrument.

121

Name: Nasekos, Josie

Major: Environmental Economics & Mgt

Faculty Advisor: Alba J. Collart, Agricultural Economics

Funding: USDA NIFA AFRI ELI Research and Extension Experiential Learning for Undergraduates (REEU) Fellowships Program

Food Insecurity: Paying the Price During the COVID-19 Pandemic

The COVID-19 pandemic and its aftermath have impacted the lives of millions of people, disrupting not only public health but also food supply chains. Consumer food prices increase over time, but recent increases are faster than usual. In December 2022, the U.S. Consumer Price Index for food was 24% higher than in January 2019, before the pandemic. Aggregate prices for eggs, poultry, meat, and seafood rose 29% over this period, with egg prices alone rising by 71%. Prices for fruits and vegetables increased too, albeit slower than other food categories, with prices for processed fruits and vegetables rising more than for fresh produce. Changes in food prices may affect the number of low- and no-income individuals participating in food-purchasing assistance programs, such as the federal Supplemental Nutrition Assistance Program (SNAP). Our research examines changes in SNAP participation resulting from changes in food prices during the COVID-19 pandemic and changes in SNAP participation relative to pre-pandemic levels at the national and regional levels. At the national level, we find that a 1% increase in food prices is associated with an increase in SNAP participation of 2.08 million people over the period comprised between March 2020 (when the World Health Organization declared COVID-19 a pandemic) and November 2020 (when the Food & Drug Administration authorized emergency use of a COVID-19 vaccine in the United States). Our models also examine differences in SNAP participation and food prices across U.S. regions.

32

Name: Nepali, Shanti

Major: Aerospace Engineering

Faculty Advisor: Shreyas Narsipur, Aerospace Engineering

Characterization of 2D and 3D Non-Circular Bluff Body Wakes

This research investigates the behavior of the wake behind the different shapes of non-circular bluff bodies. Reynolds number of 2.5×10^5 has been used to examine the flow behind the bluff bodies. The Reynolds number used is based on the length of the average size of the building and the average free stream velocity. With the increasing popularity of urban aerial mobility (UAM) technologies, it is important to understand the wakes behind the non-circular bluff bodies. Studies behind the wakes of circular bluff bodies have already existed. Therefore, this research effort is to study the wakes behind non-circular bluff bodies and understand whether the wake's behavior depends only on the Reynolds number or other features such as the length of the body. This helps in the prediction of aerodynamic characteristics of non-circular bluff bodies. Previous studies have indicated the dependency of wakes behind square cylinders on Reynolds number $Re < 10^7$. Investigations of wake's behaviors behind non-circular bluff bodies have been done with different Reynolds numbers, considering it as the most prominent parameter for the significant alterations of the wake's behavior. However, the data abstracted from the numerical simulation in Ansys Fluent with variable length of the body and constant Reynolds number suggests its effect on the behavior of the wake. Three non-circular bluff bodies of square shape, with variable lengths of 0.2, 0.3, and 0.4 meters are employed in this study with a constant Reynolds number of 2.5×10^5 . The CFD analysis of the wake's behavior showed dependency on various parameters such as Strouhal number, velocity, vorticity, circulation, and efflux angle of the vortices of the wakes. The coefficient of Drag (C_d) of about 2.2 and lift coefficient (C_l) of 0 was observed in all three simulations. However, the velocity and vorticity of the flow behind the body were different for all three bodies studied, which suggests that the Reynolds number alone is not enough to characterize the behavior of the wake behind the body. Therefore, the geometry of the body along with the Reynolds number is observed to be responsible for the significant alteration of the wake's behavior. The flow separation point is fixed in the square cylinder bluff. The vortex formed in different structures due to the wakes are used to observe the shedding frequency, which is normalized as Strouhal number $St = fD/U$, which is a function of shedding frequency, a characteristic body dimension, and the free stream flow velocity. Further simulation and experimental validation are required to understand the shedding frequency, wake width, vortex shedding, and Strouhal number of the wakes behind the bluff body.

53

Name: Nguyen, Bryan

Major: Music Education

Faculty Advisor: Anthony Kirkland, Music

Insight into a Composer's Process—"Hymn for Northern Waters"

The work of a composer is to bring musical ideas to life. This journey springs from the mind's inspiration, is refined through the creative process, and into the interpretive hands of performers. This showcase, featuring an original composition by the presenter ("Hymn for Northern Waters," for trumpet choir) will showcase the presenter's personal process of composition. The initial melody arose from the connection between folk songs and the pentatonic scale—a pitch set that exists in most cultures. The melody is then contextualized with harmony and is refined. Finally, the piece is set to be rehearsed by performers, who continually workshop the piece with the composer. Demonstration of examples by live performers—the Trumpet Consort, led by Dr. Anthony Kirkland—will be provided, culminating in a full performance of the original composition at the end.

62

Name: Nichols, Andrew

Major: Anthropology

Faculty Advisor: Anna Osterholtz, Anthropology and Middle Eastern Cultures

Sexual dimorphism in the humeri at Tell Abraq as seen by metric analysis

Estimation of sex is an integral part of skeletal analysis, as sex influences lived experience. The commingled assemblage from Tell Abraq (2100-2000 BCE, UAE) is the result of a community ossuary in use for a relatively short period of time. It contains the remains of over 400 individuals from this fishing and farming community. The assemblage was excavated in the 1990s and has been used to reconstruct lived experience in Arabia since its recovery. Previous techniques used to estimate sex within the assemblage have found the breakdown of males-females to be 65% male and 35% female. This study tests updated metric methods to estimate sex using the humerus. This was accomplished by taking standard osteological measurements at nine locations throughout the humerus. Overall, the results are consistent with previous sex estimations done for the commingled assemblage of Tell Abraq. This study shows that current metric methods for the humerus give a consistent understanding of the demographic distribution of the assemblage, allowing for estimated sex to be used as a baseline variable for further research into pathologies, traumas, and other elements of lived experience in the past.

122

Name: Nichols, Lauren

Major: Anthropology

Faculty Advisor: Molly Zuckerman, Anthropology and Middle Eastern Cultures

Funding: ORED Undergraduate Research Program

Reclaiming Life Narratives: Reconstructing lived experiences of individuals in historical documented collections.

Historical documented collections, like the Hamann-Todd Osteological Collection (HTOC), are fundamental to method and theory-development in biological anthropology. However, these collections were created through structural violence (e.g., nonconsensual anatomization), and recent scholarship on ethics surrounding these collections raises questions of how the biosocial conditions and lived experiences of individuals within them can be foregrounded, encouraging researchers to engage with them as once-living individuals and reducing their scientific objectification. We build on this, employing osteobiography as a humanizing strategy; we present an osteobiography of an individual, Cleveland Individual (CI), from the HTOC, who has an antemortem diagnosis of acquired syphilis. We applied a 10-biomarker skeletal frailty index (SFI) (PH/CO, Rickets/Osteomalacia, Osteoporosis, LEH, Periodontal Disease, Neoplasms, OA, IVD, RCD, Fracture) and assessed evidence of other select pathologies. We integrated these with CI's archival data and community-level historical information on early 20th c. Cleveland, OH. Preliminarily, CI has a relatively low age-at-death (38 years) and SFI (3) relative to a larger sample of those with syphilis (N=88; SFI=4.15) in the HTOC, indicative of physiological stress during growth, repetitive activity during adulthood, and possible TB co-infection. We interpret these as embodied stressors potentially associated with CI's reconstructed social identity (e.g., gender, migrant status, SES), and related processes of poverty, psychosocial and physical stress, and ante-, peri-, and postmortem structural violence. Such attempts to highlight the personhood and osteobiographically reconstruct the complex life narratives of individuals in historical documental collections may encourage more ethical research with them.

219

Name: Norman, Grant

Major: Kinesiology

Faculty Advisor: Stamatis Agiovlasis, Kinesiology

Co-Author(s): Brantley K. Ballenger, Sydney L. Carter

Funding: ORED Undergraduate Research Program, I'm an Athlete Foundation

Peripheral and Central Arterial Stiffness and Hemodynamics in Adults With and Without Down Syndrome

BACKGROUND: Adults with Down syndrome (DS) have decreased levels of arterial stiffness compared to same age peers without Down syndrome (non-DS). This is thought to be due to lower blood pressure among adults with DS. The purpose of this study was to compare central and peripheral arterial stiffness between adults with and without DS who were matched for age and blood pressure. **METHODS:** Seventeen adults with DS (age 38±9 yrs.; 10 men) and 17 adults without DS (age 36±11 yrs.; 7 men) underwent measurement of body composition by bioelectrical impedance. Central and peripheral arterial hemodynamics and stiffness were measured by carotid-femoral (CF-PWV) and carotid-radial pulse wave velocity (CR-PWV) analysis, respectively. Independent samples t-tests were performed to investigate differences between groups in hemodynamics, arterial stiffness, and augmentation index (AIx). **RESULTS:** No significant differences were present between groups for central or peripheral systolic blood pressure ($p=.320$; $p=.194$), diastolic blood pressure ($p=.102$), or mean arterial pressure ($p=.251$). Significant differences were present between groups for height (DS: 151±9 cm, non-DS: 172±12 cm, $p<.001$), BMI (DS: 33±5 kg/m², non-DS: 26±5 kg/m², $p<.001$), and body fat percentage (DS: 32±7%, non-DS: 27±9%, $p=.042$), but not for weight (DS: 77±13 kg, non-DS: 77±21 kg, $p=.496$). CF-PWV was significantly greater in non-DS (DS: 6±1 m/s, non-DS: 8±2 m/s, $p=.012$), but no differences were present between groups for CR-PWV (DS: 9±2 m/s, non-DS: 10±3 m/s, $p=.139$). Peripheral AIx was significantly greater in adults with DS (DS: 10±21 percent, non-DS: -7±20 percent, $p=.012$), but central AIx did not differ between groups (DS: 2±20 percent, non-DS: -8±21 percent, $p=.088$). **CONCLUSION:** Our findings confirm past research demonstrating lower central arterial stiffness in adults with than without DS. However, we found no difference between groups for peripheral arterial stiffness. These findings may be due to differences in body fat percentage or AIx between groups.

220

Name: Norris, Katie

Major: Poultry Science

Faculty Advisor: Maryam K. Mohammadi-Aragh, Agricultural and Biological Engineering

Co-Author(s): G. Daniel Chesser, Jr., Jeffrey D. Evans, Joseph L. Purswell, J. Wesley Lowe

Funding: College of Agriculture and Life Sciences URSP

Evaluating the effects of biochar and poultry litter treatment (PLT) on E. coli populations, ammonia volatilization, and moisture content in broiler litter

Broiler litter management is important for overall bird health and performance. Litter that is not managed properly may provide an environment for high ammonia volatilization and microbial growth, including pathogens. Litter amendments such as Poultry Litter Treatment (PLT®) have been applied to mitigate ammonia; however, PLT® does not address microbiological activity (MA) or moisture content (MC). Biochar (BC) is a porous, absorptive material with high surface area that has reduced MA when applied to used broiler litter. The objectives of this study were to assess the effects of pine BC and PLT on MA (as indicated by the abundance of *E. coli*), ammonia volatilization, and litter MC during a live bird trial. BC and PLT were surface applied at 30% (v/v) and 0.73 kg/m², respectively. A control of no litter amendment was also included. Ammonia was measured at days 0, 14, 28, and 41, and litter was collected from each room on days 0, 17, 29, and 41 to analyze MC and MA. The impacts of litter amendments were statistically analyzed using Proc Mixed in SAS with a P-value ≤ 0.05. Litter treatment and grow-out time significantly affected ammonia volatilization. On day 41, BC had significantly higher ammonia and was over the recommended levels. Ammonia decreased from days 0 to 29, and then significantly increased from days 29 to 41. MC across treatments was not significantly different; however, BC had the lowest average MC at each collection period. MC significantly increased from day 0 to 41 for all treatments. This was likely due to increased moisture deposition as birds grew. Litter treatment did not significantly affect MA; however, *E. coli* counts were significantly lower in BC-treated litter compared to the control at day 41.

123

Name: O'Donnell, Ashley

Major: Psychology

Faculty Advisor: Arazais Oliveros, Psychology

The Impact of Single vs. Poly Victimization by Maltreatment Type on Pre-Treatment PTSD Scores

Studies show that an estimated 21-50% of children who have experienced maltreatment will develop post-traumatic stress disorder (PTSD) within their lifetime (Schuck & Widom 2019). Research suggests that the type and number of exposures to trauma may influence symptom severity. Further, trauma symptom scores of children who experienced child sexual abuse (CSA) were higher among the

children who endorsed poly-victimization, meaning when CSA was combined with another form of maltreatment (Racine et al 2022). This study seeks to examine the impact of poly-victimization and combined types of maltreatment on children's PTSD scores in an archival dataset from a child advocacy center (CAC) serving children exposed to various forms of trauma. Participants from the overall child sample (N = 721) who have pre-treatment PTSD scores (n = 290) will be analyzed. The analyzed sample includes 83 minors exposed to poly-victimization, 175 exposed to single victimization, and 32 where the trauma type was missing from the dataset. Specifically, the following hypotheses will be tested: (1) victims of poly-victimization will have higher PTSD scores than victims of single victimization; (2) among participants with poly-victimization, those with a combination of sexual abuse and physical abuse will have the highest PTSD scores compared to other combinations. Results will be discussed in the context of current referral pathways for child advocacy centers.

124

Name: Ogletree, Sadie

Major: Fashion Design & Merchandising

Faculty Advisor: JuYoung Lee, Human Sciences

Co-Author(s): Anna Hollowell, Erynn Boger, Jordan Mize

The Impact of Emotional Support Animals on Mental Health

Many studies have explored the effect of emotional support animals on college students' mental health (Binfet et al., 2017). Emotional support animals have been shown in studies to minimize symptoms of anxiousness and depression, reduce stress, and increase energy (Brooks et al., 2018). Mental health describes a person's condition with regard to their physiological and emotional well-being (Bergen, 2017). Among the long list of mental health issues, depression and anxiety are the top two mental health issues with which college students are diagnosed. According to The American College Health Association, 51% of college students reported feeling hopeless, 40% reported depression levels that impaired their ability to function, and in the 12 months preceding the questionnaire, 11% seriously considered suicide (Binfet et al., 2017). Emotional support animals are typically dogs and cats. Still, they may include other animals of any species that provide support, well-being, comfort, aid, or a calming influence through companionship, non-judgmental positive regard, affection, and a focus in life simply by being close to their handler. This research aims to determine if having an emotional support animal promotes positive mental health for college students. The objective of this research to learn and investigate the relationship between how an emotional support animal enhances and college student one's mental health, specifically depression, and anxiety. This study will survey college students using Qualtrics, and the data will be analyzed using multiple regression analysis. The survey will consist of questions regarding anxiety, depression, distance to the hometown, and if an animal ever played a role in boosting their mental health through affection or supportemotional support animal companionship.

63

Name: Overstreet, Ellen

Major: Architecture

Faculty Advisor: Duane McLemore, Architecture

3D Printing Clay for Use in Architecture: Formulation and Production Process

This study explores how the principles and tools of computational design can be used to create a vaulting structure with a building material that still needs exploration. Computational design is becoming more important in architecture as it can offer a non-traditional approach to design that can streamline production processes. This is accomplished through the efficiency in the conceptualization, planning, and verification of the starting assumptions that this mode offers. The design and simulation of the properties can become a case study in the application of a computational workflow to a real-world experiment. The software used to conduct this research includes Rhinoceros 6, Rhino Vault 2.0, and Grasshopper. Each of these programs is commonly used by architects for computational design, and, for this study, they are being broken down and documented to make the learning process easier for future students. The building material being used for this research is 3D-printed clay. The clay is printed into several small units using a Potterbot that are then attached to create a larger, vaulting structure. Once the clay has been printed, the process for creating units is the same as that of traditional pottery: the clay is fired in a kiln, glazed, then fired once more. The workflow for the project's continuation and instruction manuals for each program and machine is recorded before it can be realized as a full structure.

33

Name: Paganucci, Mary Grace

Major: Chemistry

Faculty Advisor: Todd E. Mlsna, Chemistry

Co-Author(s): Prashan M. Rodrigo, Bailey N. Bullard, Jane A. Dill, Tharindu N. Karunaratne, Xuefeng Zhang, Charles U. Pittman Jr.

Funding: Creekside Environmental Products

Use of Calcium Silicate Deposited Rice Husk Biochar as Cement Additive

Rice husks are lignocellulosic biomasses (28–38% of cellulose, 9–20% of lignin) with high silica contents (18.8–22.3%) and element-wise 39.8–41.1% of C, 5.7–6.1% of H, 0.5–0.6% of N, 37.4–36.6% of O. In this project, inert SiO₂ in rice husks was extracted by adding KOH, then redeposited on the rice husks' surface by adding CaCl₂, followed by pyrolysis at 400°C for 2 hrs to convert CaO-SiO₂/RHBC. RHBC and CaO-SiO₂/RHBC were characterized by powdered X-ray diffraction technique and elemental analysis. By completing the modification process, the crystallinity increased by 2.6 times compared to RHBC. The effect of biochar loading, curing age, salt effect, cement replacement, and water-cement ratio experiments were performed to evaluate the effects of adding CaO-SiO₂/RHBC to the cement paste. In the effect of the biochar loading experiment, seven treatments (control, 3% RHBC, 1%-5% CaO-SiO₂/RHBC with respect to cement amount) were performed to make concrete blocks and cured for 28 days in an open vessel. During this period, the percentage of water loss in the blocks was observed. After the blocks were cured, the compressive strength was measured. The 4% CaO-SiO₂/RHBC had the smallest amount of water loss and the highest compressive strength, 1.44 times greater than the control. In the curing age experiment, the compressive strength of blocks was tested after 4, 7, 14, 21, and 28 days. In the salt effect experiment, the water was replaced with different concentrations of a NaCl solution (5 M, 0.5 M, 0.05 M, 0.005 M), cured for 28 days; then, the comprehensive strength was measured. These results conclude that 4% loading of CaO-SiO₂/RHBC can act as nuclei in the process of aggregation in cement paste.

221

Name: Palmer, Emma

Major: Biochemistry

Faculty Advisor: Natraj Krishnan, Biochemistry, Molecular Biology, Entomology, and Plant Pathology

Co-Author(s): Caleb Snoddy, Peyton York

Funding: College of Agriculture and Life Sciences URSP

Friend or Foe? Investigating the expression of matrix metalloproteinases in a Drosophila model of Spinocerebellar ataxia type 1 (SCA1)

Matrix metalloproteinases (MMPs) are a family of zinc- and calcium-dependent endopeptidases that are responsible for degrading extracellular matrix (ECM) proteins. The ECM is a complex and dynamic facet of tissue architecture, which is known to play fundamental roles in development, wound healing, tissue homeostasis, and a host of pathological processes. Dysregulation of MMPs has been implicated to be the proximal factor in many diseases and disorders including neurodegenerative disease. Dysregulation of MMPs can be detrimental to neuronal function and can enhance neurodegeneration. MMPs can be a double-edged sword, due to their essential function in neurorepair and their destructive function in neurodegeneration. Around 23 different MMPs are found in the human genome with overlapping functions, making the analysis of the role of human MMPs a daunting task. Investigating the biology of MMP in model organisms with simple MMP families will allow for elucidating the function of specific proteases. The fruit fly *Drosophila melanogaster* with only two MMP genes, dMMP1 and dMMP2 offers an excellent model system to investigate MMP function in the nervous system. In the fly, MMP activity in the developing nervous system is essential for both axon pathfinding and dendritic plasticity in the brain. The full-length amino acid sequence alignments of dMMP1 and dMMP2 with the full-length amino acid sequences of 23 human MMPs ranging from MMP1 to MMP28 were conducted using Clustal Omega. A phylogenetic tree was constructed with MEGA 7.0 using the neighbor-joining method. Additionally, the gene expression of dMMP1 and dMMP2 was investigated in a *Drosophila* model of Spinocerebellar ataxia type 1 (SCA1) expressing the human abnormal Ataxin-1 with 82 CAG repeats. Nuclear localization signal sequences were predicted for Ataxin protein and dMMP1 and dMMP2 using NLS Mapper. This study will lay the foundation for further research on unraveling the discrete molecular mechanisms underlying the intracellular role of MMPs in neurodegenerative disease pathology.

125

Name: Patterson, Camden

Major: Psychology

Faculty Advisor: Mary E. Dozier, Psychology

College Students' Stimulant and Social Media Use Associated with and Without an ADHD Diagnosis

Attention Deficit/Hyperactivity Disorder (ADHD) is categorized by inattention and hyperactivity that disrupts a person's daily life (American Psychiatric Association, 2013). This mental health disorder is most frequently treated with psychostimulant medication (Pliszka, 2007). Misinformation about ADHD may be spreading around on multiple social media platforms. This misinformation may cause people to self-diagnose themselves with ADHD and possibly self-medicate with stimulant drugs, which can range from caffeine to prescription drugs. Understanding the link between social media use, ADHD diagnoses, and stimulant use will allow us to design preventative interventions for the misuse of prescription and non-prescription stimulants. Participants were adults aged 18 and over who were part of the Psychology Research Pool at Mississippi State University. The study was an online questionnaire that asks the participant about their use of social media and stimulants. These answers were compared based on the participant's history of an ADHD diagnosis. The goal is to compare three groups of emerging adults on their social media and stimulant use: adults with an ADHD

diagnosis, adults without an ADHD diagnosis who believe that they meet the criteria for a diagnosis, and adults without an ADHD diagnosis who do not believe that they meet the criteria for a diagnosis. Our hypothesis is that those with a diagnosis for ADHD will have similar use of social media and stimulants to those without a diagnosis but believe they meet all of the criteria for one.

126

Name: Paul, MacKenzie

Major: Psychology

Faculty Advisor: Kevin Armstrong, Psychology

Funding: Shackouls Honors College Research Fellowship

Issues affecting cross-referrals between Oktibbeha County clergy and mental health professionals

Throughout much of the United States, religious leaders operate as first responders for mental health issues within their congregations. Clergy members serve a prominent role in communities and may substantially influence their congregations' perceptions of when normal suffering or distress becomes a mental health issue. The importance of clergy is underscored by findings that nearly one-fourth of U.S. adults affected by mental illness report contacting their religious leaders for mental health support. This relationship may be especially evident within highly religious states like Mississippi. Clergy members regularly serve parishioners with a wide range of personal concerns (e.g., grief, child discipline, marital/family relationships, anxiety, depression, and PTSD). However, many religious leaders have minimal professional counseling training. A parallel issue exists among mental health professionals. Within the Bible Belt, most clients report having significant religious beliefs and practices, but not all mental health professionals have the spiritual/religious competency training necessary to provide informed care. Increasing attention has been brought within the mental health field towards developing the competencies necessary to effectively consult with clergy and to participate in effective cross-referrals with local pastors. In an effort to improve cross-referral success between clergy and mental health professionals in Oktibbeha County, members of both groups were invited to a workshop where they are scheduled to review a variety of issues together and answer questions regarding what supports effective cross-discipline experiences and what barriers or obstacles exist to achieving positive outcomes for their clients and congregants. This project will summarize what is learned about each group's experiences, attitudes, and intentions regarding cross-referrals in this community. The workshop is intended to identify essential information for the creation of a clergy-counselor network that could support effective collaborations.

127

Name: Paul, MacKenzie

Major: Psychology

Faculty Advisor: Colleen Sinclair, Louisiana State University Social Research & Evaluation Center

Co-Author(s): Wicks, S.

Funding: Shackouls Honors College Research Fellowship

It goes both ways: Friend opinions affect romantic relationship outcomes and romantic partner opinions affect friendships

Decades of research on the social network effect has demonstrated that friend disapproval of a romantic partner is related to poor romantic relationship outcomes. Less is known, however, regarding the influence of the romantic partner's disapproval of a friend on the friendship. To explore this relationship, we surveyed students from a Southeastern university (N = 315) about their perception of their friend's approval of their partner, and vice versa, and assessed satisfaction level, quality of alternatives, investment size, and commitment level for the romantic relationship and friendship. Analyses revealed that the effect of network opinions were stronger when mediation was considered. Namely, that network opinions affected commitment by influencing relationship satisfaction, investment, and alternatives. The results of this study replicate and extend findings regarding the social network effect and integrates it with Rusbult's Investment Model.

222

Name: Person, Xavier

Major: Biomedical Engineering

Faculty Advisor: Lauren B. Priddy, Agricultural and Biological Engineering

Co-Author(s): Xavier J. Peron Luke J. Tucker Bailey E. Roux

Funding: Shackouls Honors College and ORED Undergraduate Research Program

In vitro characterization of chitosan hydrogel and polylactic acid microparticle delivery vehicle

Osteomyelitis, an infection of the bone, is most commonly caused by *Staphylococcus aureus* (*S. aureus*) and is treated with high doses of antibiotic either intravenously or orally over extended periods of time. Localized antibiotic delivery, however, may allow higher doses an avenue to circumvent risks associated with traditional antibiotic regimens. Our objective was to evaluate the effectiveness of chitosan (CH) hydrogel delivery vehicles loaded with antibiotic against *S. aureus* in vitro. CH hydrogels are injectable, thermosensitive,

biocompatible materials possessing innate antimicrobial properties and can be used for localized antibiotic delivery to combat osteomyelitis. Here, fosfomycin (FOS), a broad-spectrum antibiotic, was loaded either in CH hydrogel, in polylactic acid (PLA) particles within the CH hydrogel, or in both the CH and PLA. Blank CH served as a negative control, and phosphate buffered saline (PBS) containing FOS served as a positive control. We hypothesized that the combo group (CH-FOS + PLA-FOS) would reduce bacterial load compared to the other treatment groups (CH, CH-FOS, CH + PLA-FOS). A Kirby-Bauer assay demonstrated all FOS-containing groups possessed larger zones of inhibition compared to the blank CH group, indicating more bacterial cell death. A planktonic antimicrobial assay revealed bacterial load at 24 hours was lower for CH + PLA-FOS compared to blank CH; further, at 48 hours, bacterial load for all CH groups containing FOS were lower than blank CH and PBS-FOS groups and were reduced from 24 hours. Similarly, a biofilm antimicrobial assay revealed lower bacterial load for all CH groups containing FOS compared to blank CH and PBS-FOS at both 24 and 48 hours. This work demonstrates the antimicrobial efficacy of a novel chitosan-based delivery vehicle against *S. aureus* as an alternative, localized treatment for osteomyelitis infections.

223

Name: Peters, Morgan

Major: Biochemistry

Faculty Advisor: Natraj Krishnan, Biochemistry, Molecular Biology, Entomology, and Plant Pathology

Co-Author(s): Peyton York, Caleb Snoddy

Funding: College of Agriculture and Life Sciences URSP

Wrestling with neurodegeneration: SUMOylation in brains of a *Drosophila* model of spinocerebellar ataxia type 1 (SCA1)

Spinocerebellar ataxia type 1 (SCA1) is a dominantly inherited progressive neurodegenerative disease that results in atrophy of cerebellar Purkinje cells. SCA1 is caused by the expansion of a CAG trinucleotide repeat tract in the ataxin-1 gene, resulting in an abnormally long polyglutamine tract within the protein. Accumulation of mutant ataxin-1 [82Q] into nuclear inclusions is a hallmark of the disease. Protein modification by small polypeptides is an important mechanism for regulating protein events such as trafficking, aggregation and degradation. Ubiquitin is one such attachment. SUMO (small ubiquitin-like modifier) is a member of the ubiquitin family of proteins. SUMO targets include proteins involved in numerous roles including trafficking, transcriptional regulation, degradation etc. A role for SUMOylation in the pathogenesis of neurodegenerative diseases and associated SUMOylated proteins include Huntington's disease (huntingtin), Parkinson's disease (tau, α -synuclein, DJ-1, Alzheimer's disease (tau, APP), spinocerebellar ataxia 1 (ataxin-1) among others. An unresolved question is: What is the precise role of SUMOylation in the disease process? Alternatively, does an increase or decrease of SUMOylation impact disease pathology? To answer this question, the initial steps in the SUMOylation pathway were investigated in a *Drosophila* model of SCA1 expressing the abnormal human ataxin-1 [82Q]. The expression of genes encoding two subunits of the Sumo activating enzyme (E1) heterodimer complex - Aos-1 (activator of Sumo) and Uba2 (ubiquitin activator) as well as Sumo (dSmt3) were studied. Results demonstrated that, in general, SCA1 flies have heightened neurodegeneration in comparison to age-matched 30-day old control flies. Additionally, sumo gene expression is markedly reduced, indicative of reduced Sumo protein levels and hence of SUMOylation. Interestingly, Aos1 and Uba2 gene expression were both significantly elevated in 30-day old SCA1 flies in comparison to control flies. This could be indicative of a feed-back regulatory mechanism where augmented E1 activating enzyme levels could be a compensatory response to decline in SUMO protein. These results point to a role for reduced SUMOylation in the disease progression.

224

Name: Peterson, Grant

Major: Wildlife, Fisheries & Aquaculture

Faculty Advisor: Sandra Correa, Wildlife, Fisheries, and Aquaculture

Co-Author(s): Autumn Carroll

Funding: College of Forest Resources Undergraduate Research Scholars Program

Diversity and habitat selection among larval fish in seasonally flooded forests along the Pascagoula River

Seasonally flooded forests provide services such as water purification, flood control, temperature regulation, and habitat for animals like fish and waterfowl. As deforestation and human-altered hydrology threaten river-floodplain forests, understanding the role these understudied ecosystems play in the lives of aquatic organisms is critical. While research has shown that flooded forests represent key habitat for adult fish, little is known about fish in early life stages. Our goal was to determine the species composition of larval and juvenile fish communities in flooded forests along the Pascagoula River, the last major river in the U.S. with unaltered hydrology. We hypothesized that 1) species composition will be the same for young and adult stage fishes, 2) larval fish will be most abundant in spring and summer, and 3) flooded forests represent critical habitat for young fish. Each month between November 2021 and October 2022 (excluding June-August), we sampled fish in three flooded forest sites along the upper and lower reaches of the Pascagoula River using a set of three light traps and one mini-fyke net per site. We also recorded depth and water quality measurements, such as chlorophyll-a, pH, conductivity, ammonium, and temperature, using a HydroLab sonde. Ultimately, 2,326 fish were captured and preserved in 99% ethanol. In the lab, fish were photographed, measured, and sorted into 39 morphotypes with cyprinids and

centrarchids being most abundant. Our preliminary analysis shows that Shannon Diversity is higher on the upper reaches of the Pascagoula. Additionally, we found that larval fish are more abundant during the high-water hydrological period (January-May). Over the coming months, we will 1) use DNA sequencing to verify the species identity of each fish morphotype, 2) conduct multivariate (ordination) and matrix correlation (Mantel test) analyses, and 3) compare results with existing data on adult fish collected in the same sites.

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Name: Phillips, Anne Louise

Major: English

Faculty Advisor: Tommy Anderson, Shackouls Honors College

Forgiveness in *The Winter's Tale* and *The Gap of Time*

"Hermione is chaste," declares the Oracle in Scene 1 Act 3 of Shakespeare's *The Winter's Tale*. The full revelation of the Oracle in Shakespeare's late play about the power of forgiveness exhibits the importance of truth in relation to forgiveness. Jeanette Winterson's *The Gap of Time*, a "cover" of Shakespeare's *The Winter's Tale*, reinterprets the classic play as a modern novel, changing some key elements of the original narrative. In Winterson's adaptation, she creates a world where Hermione is not chaste, Polixenes is not innocent, and Leontes doesn't repent. Forgetting the past then provides the characters with a convenient illusion of overcoming trauma. These changes demonstrate that Winterson, in her novel, misreads what's most powerful in the play. I will argue in this paper that, in the end, these changes fully empty Shakespeare's foundational narrative of its magic and meaning.

225

Name: Phillips, Maggie

Major: Biomedical Engineering

Faculty Advisor: Matthew K. Ross, Comparative Biomedical Sciences, Center for Environmental Health Sciences, College of Veterinary Medicine

Funding: Shackouls Honors College Research Fellowship

Hydrolytic Metabolism of Arachidonic Acid-containing Triacylglycerols by CES1 in Macrophages

Triacylglycerols (TAGs) are lipids found in cytoplasmic lipid droplets. Toll-like receptor activation causes increased TAG accumulation in macrophages and enhances their inflammatory function. The increase in TAG-containing lipid droplets in the setting of inflammation is due to both enhanced biosynthesis and reduced fatty acid release. Human carboxylesterase 1 (CES1) is a member of the serine hydrolase superfamily and catalyzes the hydrolysis of TAG lipids, including those containing oxidized polyunsaturated fatty acids. CES1 is expressed in monocytes/macrophages, although its function in these cells is unclear. When CES1 expression was stably knocked down in THP-1 macrophages, marked increases in arachidonic acid-containing TAGs was detected by LC-HRMS; ~15-20-fold higher levels than those in control THP-1 macrophages where CES1 expression was normal. In addition, the metabolic fate of 15-hydroxyeicosatetraenoic acid (15-HETE), which is the enzymatic product derived from IL-4-induced ALOX15, was found to be significantly altered in the CES1 knockdown (KD) cells. Exogenously added 15-HETE (300 nM) was rapidly metabolized in macrophages by peroxisomes to tetranor 15-HETE derivatives, or it was metabolically incorporated into the TAG pool. Interestingly, we found that the level of esterified 15-HETE in TAGs was ~7-fold higher in CES1KD cells than in control cells after a 6-hr treatment. Furthermore, both RNA-seq and RT-qPCR data indicated that there were pronounced differences in the responses of control and CES1KD macrophages to M1 and M2 inflammatory stimuli (LPS/IFN γ and IL-4, respectively), with the CES1KD macrophages exhibiting a more pro-inflammatory phenotype. The observed metabolic changes in TAG/oxylipin disposition and the resulting altered immunophenotype in the CES1KD cells is likely due to the reduced TAG hydrolytic activity and subsequent buildup of cellular TAGs, which enhances inflammation.

34

Name: Pish, Jared

Major: Psychology

Faculty Advisor: Todd Mlsna, Chemistry

Co-Author(s): Chathuri Peiris, Tharindu N. Karunaratne, Oshani Nayanathara, Xuefeng Zhang, Sameera R. Gunatilake

Funding: Creekside Environmental and Products

Comparative Analysis of Carbothermal and Borohydride Reduction Methods for Synthesizing Biochar-supported Iron Nanoparticle Composites

Nanoscale zero-valent iron (nZVI) has potential for remediation of pollutants in soil and water, but its effectiveness can be limited by aggregation and passivation, resulting in decreased reactivity. Because of this, biochar has been used as a support for nZVI, preventing aggregation and increasing reactivity. The present study investigates the stability and performance of biochar-supported nZVI (BC/nZVI)

using two different synthesis methods: liquid phase reduction (LPR) and carbothermal reduction (CTR). Iron loading of the synthesized materials was 5% and 15%, and XRD, SEM, and BET techniques were used to characterize the synthesized materials and to investigate structural changes resulting from aging. Cu removal was tested to evaluate the performance of BC/nZVI, with stability testing performed in air, water, and soil. XRD analysis revealed that nZVI synthesized via CTR are more crystalline than the LPR method based on the peak width analysis. BC-Fe⁰15 synthesized via LPR had 31.83 ± 0.49 mg/g Cu removal (212.22 ± 9.23 mg/g per Fe⁰), which decreased by 2.5 times after 7-day air exposure and had a similar decrease when exposed to water for 1 hour, suggesting greater stability in air. However, BC600-G@Fe⁰15% synthesized via CTR had 39.87 ± 0.39 mg/g Cu adsorption (265.80 ± 0.42 mg/g per Fe⁰), which only decreased by 1.1 times, indicating better air stability. Moreover, the BC-Fe⁰15 synthesized via CTR showed 1.3 times more Cu removal than nZVI synthesized via LPR after 1 hour in soil, suggesting that BC-Fe⁰15 prepared via CTR has increased soil stability and a stronger magnetic property than that of LPR. The results suggest that BC/nZVI synthesized via CTR has better air and soil stability, controlling the oxidation of Fe⁰, while the use of biochar as nZVI support enhances reactivity and stability. Synthesis method can also affect the performance of BC/nZVI. Keywords: Iron nanoparticles, stability, heavy metal removal

128

Name: Pittman, K'Lee

Major: Psychology

Faculty Advisor: Danielle Nadorff, Psychology

Co-Author(s): Davis, A., Chapman, L. A., Lopez, A. R.

Connection Between Experiences of Discrimination and Mental Health in Emerging Adults Who Were Raised by a Grandparent

Emerging adults who identify as a racial/ethnic minority are at the highest risk for developing symptoms of depression and anxiety, partially accounted for by experiences of discrimination. Protective factors for depression and anxiety include social support, particularly from family. In fact, emerging adults are closer to their families than any other generation because they are living in their parents' houses longer. Grandfamilies are an increasingly prevalent non-traditional family type in the United States. Approximately 5 million grandchildren lived with their grandparents in 2021. Children raised in grandfamilies have better mental health outcomes than those who are raised in non-kin foster care, suggesting unique protective factors in this population. Grandparents help grandchildren develop a strong ethnic identity, which is cited as a protective factor against experiences of discrimination. This study aimed to evaluate the connection between experiences of discrimination, depression, and anxiety among emerging adults who were raised in a grandfamily compared to their same-age peers. Undergraduate students were sampled (N = 370; 33% raised by grandparents). Regression analyses were conducted using SPSS PROCESS Macro. Results indicate that the relation between experiences of discrimination and depressive symptoms was significant $b = 5.56$, 95%CI [0.13, 19.98], $p = .05$. However, the relation between experiences of discrimination and anxiety was not significant, and family type did not moderate either relation. This suggests that emerging adults who experience discrimination may be at an increased risk for developing symptoms of depression. Experiences of discrimination should be screened for in clinical settings to better inform treatment planning for individuals who endorse depressive symptoms.

64

Name: Ramirez, Evelyn

Major: Architecture

Faculty Advisor: Silvina Lopez Barrera, School of Architecture

Latin America's Ever Growing Housing Crisis

According to the United Nations Economic Commission for Latin America and the Caribbean (ECLAC), Latin America and the Caribbean have one of the highest urban growth rate with its population expected to grow from 394 million to 609 million in just 30 years. From these 609 million inhabitants around 80% of them are expected to be living in urban areas by the year 2030. Despite the rapid growth of urban centers, there is not enough affordable and adequate housing for everyone to comfortably live, resulting in more than 17% of the urban population to be living in informal neighborhoods in precarious housing conditions. This problem is accentuated by the economic context where 32% of the population is living under the poverty line and 13% under the extreme poverty line. This paper studies the production of housing in Latin America focusing on grassroots initiatives, mass-housing, and cooperative housing as attempts to address the housing shortage and affordability issues. Through case studies, this paper reveals the spatial conditions of housing and how they are influenced by housing subsidies and land use regulations. Additionally, this research provides an insight on successful approaches and sustainable solutions for low-income housing in Latin America. Findings suggest the need for more coordinated efforts between governmental planning policies and initiatives from grassroots housing organizations to provide long term and appropriate solutions. Finally, this paper aims to inform future research on persistent housing issues in Latin America and beyond, encouraging community organizations, architects, and policymakers to develop appropriate and sustainable solutions for low-income housing.

35

Name: Randall, Dylan

Major: Physics

School: Mississippi School for Mathematics and Science

Faculty Advisor: Claire S. Geneser, Physics and Astronomy

Simulation of Radial Velocities (RV) to Predict Masses of Extrasolar Planets

Over 5,000 exoplanets have been discovered to date, spanning a range of demographics differing from our own solar system. Planets exert a gravitational force on their host stars, causing the star to wobble about its center of mass. Over time, the star is pulled towards and away from the observer with a given velocity. As a result, we can measure the Doppler shift (aka radial velocity) of the stellar spectrum due to the periodic tug of the unseen planet. The masses of most of these planets have been determined with these types of extremely precise spectroscopic measurements, which require 50 or more observations from both visible and infrared telescopes. As part of the MSMS Research program, high school senior, Dylan Randall, developed a simulation to predict the number of observations needed to constrain the mass of an exoplanet, so that the rest of Dr. Tanner's exoplanet research group can determine the number of nights needed on each telescope. The simulation predicts the radial velocity (RV) of a star when orbited by a planet of given radius, orbital period and estimated mass. We use the maximum velocity along line of sight, the semi-amplitude (K), to find the precise mass of the planet. In this poster, Dylan will present the equations that explain how the RV method determines planet mass, provide multiple illustrations of our simulated exoplanet RV data, and explain how these simulations predict the number of observations that are needed to confidently confirm and estimate the mass of the exoplanet. The MSMS Research program has provided an invaluable experience for Dylan as he prepares for similar scientific research in his forthcoming Bachelor's studies.

129

Name: Rendon, Sarah

Major: Communication

Faculty Advisor: Holli Seitz, Communication, Social Science Research Center

Examining Student Perceptions of Community Engaged Learning through Reflection

Community-engaged learning, an emerging pedagogy that centers a symbiotic relationship between a college or university and a community partner to foster an array of learning outcomes, is growing in regard to success in enriching student learning and improving the positive impact of higher education institutions. In order to make community-engaged learning more prevalent in higher learning institutions there needs to be established student support, but currently little is known about student perceptions of community-engaged learning and experiential learning. The goal of this research was to evaluate the impact of community-engaged learning on students enrolled in a health communication course. In this study, one section of a health communication course was taught as a non-community engaged course and another section was taught as a community-engaged course. In the non-community-engaged section (Year 1), students ($n = 19$) developed health communication messages using a health topic and audience of their choice; in the community-engaged sections (Years 2 and 3), students ($n = 29$; $n = 20$) developed health communication messages for a community partner. Results from a qualitative analysis of written reflections provide evidence of perceived social, cultural, cognitive, and affective outcomes among community-engaged sections. These findings provide evidence that students who participate in community-engaged courses leave with positive perceptions about the outcomes of their participation in the course.

130

Name: Renfrow, Cameron

Major: Psychology

Faculty Advisor: Michael R. Nadorff, Psychology

Co-Author(s): Deepali M. Dhruve

Sleepless in College: How Insomnia Impacts First-Year Undergraduates' Adjustment

Insomnia is a disturbance in normal sleep patterns and includes issues in falling asleep, staying asleep, waking up too early, and poor sleep quality. The American Psychiatric Association reports that 10% of adults—4% to 22% in different samples—meet criteria for insomnia disorder. A recent study estimated that the prevalence rate of insomnia disorder was more than double among college students (22.1%). Furthermore, insomnia symptoms are related to increased levels of depression, anxiety, stress, fatigue, worse quality of life, lower grades, low-grade point average, risky sexual and aggressive behaviors, and suicidal ideation. Although studies have examined the indirect impact of insomnia on adjustment, more research is needed on the direct effects of insomnia on college adjustment. It is especially relevant to investigate the role of insomnia in adjustment for those transitioning to college, as this time comprises major life changes of managing new stressors, including building social networks, meeting academic demands, and emotional adjustment to the role. Thus, this study investigated the association between insomnia severity and college adjustment among first-year undergraduate students. Higher insomnia severity was hypothesized to be associated with 1) worse educational adjustment, 2) worse psychological adjustment, and 3) worse relational adjustment. After providing informed consent, participants ($N =$

1360; 951 females; 78.8% white), aged 17 to 32 years ($M = 18.30$, $SD = 0.74$), completed self-report measures virtually. The Insomnia Severity Index measured insomnia symptoms. College adjustment was measured using The College Adjustment Questionnaire, with subscales measuring educational, psychological, and relational adjustment. Initial analyses suggest that insomnia severity is associated with educational, psychological, and relational adjustment. Clinical and research implications will be discussed in the poster.

36

Name: Ressel, Stephanie

Major: Aerospace Engineering

Faculty Advisor: Gombojav Ariunbold, Physics and Astronomy

Co-Author(s): Luke Hand, Bryan Semon

Funding: Texas A&M Corpus Christi

Development of a Low-Cost Compact Raman Spectrometer for General Applications

Raman spectroscopy is a powerful, non-destructive method of identifying materials through their unique molecular vibrations. Raman spectroscopy is widely applicable in a variety of fields such as archaeology, biology, nanotech, and pharmaceuticals; however, this technique lacks accessibility due to the high entry cost. Current commercial systems start at around 15,000 USD [BWTek BTR-111 Mini Raman Spectrometer]. To mend this issue a smaller, affordable, and more manageable version of a Raman setup was developed. The compact Raman spectrometer was constructed using standard optics and optomechanical components from Thorlabs, the Starlight Spectrograph Pro, and a Trius SX-814 mono CCD camera with negligible dark current. To process the Raman signal images, an open-source MATLAB program was written to assist with data analysis and can be modified for the user's various applications. The entire arrangement costs around 10,000 USD, which is relatively inexpensive compared to current market alternatives without sacrificing the Raman image quality. This system was successfully used to capture the Raman signals from leaves, dimethylformamide (DMF) and various plastic materials and microspheres. The quality of data and performance of the compact Raman setup met its commercial counterpart. These results are promising for future applications of this method, allowing students and researchers a much lower barrier to entry for this powerful technique. The current compact Raman arrangement will be further optimized through the construction of a home-made spectrometer which is projected to reduce the price by 5,000 USD.

226

Name: Rillen, Jasmine

Major: Animal and Dairy Science

Faculty Advisor: Amanda Stone, Animal and Dairy Sciences

Co-Author(s): Kevin Braman

Funding: College of Agriculture and Life Sciences URSP

Shade or Sprinkler? Examining Dairy Cow Preference for Cooling Off

Dairy cows decrease milk production and have reduced fertility at a temperature humidity index of just 68. Finding ways to alleviate heat stress can improve milk production and animal welfare. Shade is commonly used as a heat abatement method on pasture, but cows housed indoors can be effectively cooled through sprinklers invoking evaporative cooling since they cannot sweat. The objective of this project was to evaluate whether heat-stressed dairy cows chose to use shade or sprinklers to cool off immediately following morning and afternoon milkings, with a hypothesis that hotter cows would choose sprinklers. Forty-six lactating Holstein dairy cows were enrolled in this study, conducted at the Mississippi State Bearden Dairy Research Center between May 19 and 28, 2022. Cows were housed in an open pasture with both a portable sprinkler system and portable shade cloth available for heat abatement (HA). A researcher observed where cows went immediately after each milking for 7 days. A vaginal temperature logger recorded each cow's temperature (VT) within 30 minutes of each milking. The GLM procedure of SAS version 9.4 was used to evaluate the effects of vaginal temperature on chosen HA. Chosen HA was affected by VT, where cows with greater VT chose sprinklers, then shade, then grazing (38.6, 38.5, and 38.4, respectively). Vaginal temperatures were significantly different between grazing and both HA options ($P < 0.01$) but not between shade and sprinkler groups ($P = 0.23$). The results of this study indicate that cows experiencing greater heat stress levels will seek HA to cool off instead of grazing after milking.

227

Name: Rogers, Alexa

Major: Biological Engineering

Faculty Advisor: Vitor S. Martins, Agricultural and Biological Engineering

Funding: NASA

Developing an empirical model of turbidity using multi-spectral data to evaluate water quality with satellite images

The turbidity of water can be used to evaluate the concentration of pollutants present as well as give an overall indication of the health

of a water body. The ability to model turbidity with multi-spectral reflectance data and visualize the spatial information with satellite imagery provides a powerful tool for monitoring water quality. This research project explores the application of GLORIA, a global dataset for imaging and optical sensing of aquatic environments, in evaluating turbidity modeling and application in satellite imagery. The project also investigates the development of a model for predicting water quality based on GLORIA data, as well as the benefits of spatial information for society using Landsat satellite imagery. We applied this developed model in Landsat multi-spectral images in the Mississippi Gulf Coast to observe the spatial variability of turbidity levels. This research aims to provide insights into the potential of GLORIA as a dataset for modeling water quality, as well as the value of spatial data for informing decision-making processes. The findings of this study could have implications for environmental policy, conservation efforts, and sustainable development.

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Major: Biochemistry

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Funding: NanoMedical Systems, Inc.

Sustained Low Plasma Levels Of CBD Without Liver Toxicity Using A Nanochannel Delivery System

Cannabidiol (CBD) is a plant-derived cannabinoid found in marijuana and hemp that has been intensely investigated for its putative anti-inflammatory, anxiolytic and/or analgesic effects. Since all these conditions require long-term treatment, sustained release formulations are being investigated. The nanochannel delivery system (nStrada™), an implant device containing 1 mL of CBD formulation in either sesame oil (SES) or medium-chain triglyceride (MCT) vehicles was used in a 35-day sustained-release pharmacokinetic (PK) experiment in female rats. Rats were surgically implanted with either a polyetheretherketone (PEEK) or titanium (Ti) device on day 0 (D0) and blood was obtained several times a week over 35 days. Following the maximum concentration (C_{max}) at D1 of 74.3±26.9 ng/mL and 26.3±16.5 ng/mL in MCT and SES, respectively. The subcutaneous release of CBD from the nStrada™ implants exhibited sustained *in vivo* release kinetics by D14 until termination of the study on D35. The average steady-state levels were 0.8 ng/mL for CBD delivered in MCT and 0.4 ng/mL for CBD delivered in SES. At necropsy on D35, serum alanine aminotransferase (ALT) was determined, and liver histopathology was evaluated with neither revealing liver toxicity. Skin histopathology surrounding the implanted devices revealed changes consistent with fibrosis as expected. *In vitro* release data confirm consistent delivery of CBD into media containing phosphate buffered saline (PBS) with 5% Labrasol. Overall, these results provide a pre-clinical evaluation of CBD PK following implantation of a constant release device over 35 days and confirm at these CBD plasma levels, there is no concern for liver toxicity.

229

Name: Roux, Bailey

Major: Biochemistry

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Funding: CALS URSP and ORED Undergraduate Research Program

Fosfomycin Loaded in Chitosan Hydrogel and/or Poly(lactic Acid) Microparticles Challenged with *in vivo* Rat Osteomyelitis Model

Osteomyelitis, inflammation of the bone, is commonly caused by *Staphylococcus aureus* (*S. aureus*) bacterial infection. Current treatment includes surgical debridement and systemic antibiotics which can lead to toxicity, recurring infection, and antibiotic-resistant bacteria. Localized antibiotics can reduce these risks by extending release and minimizing systemic effects. Our objective was to evaluate the effectiveness of chitosan hydrogel and poly(lactic acid) (PLA) microparticles for delivery of fosfomycin (FOS) antibiotic in a rat osteomyelitis model. Chitosan hydrogel (CH), a polysaccharide with innate anti-microbial properties, can be used for local, injectable delivery of antibiotics. FOS can be loaded into CH and/or PLA microparticles embedded within the CH gel, which may extend the release of FOS. A combo group of FOS loaded in both CH and PLA was used; blank CH served as the negative control. We hypothesized FOS loaded in both CH and PLA would reduce bacterial load compared to FOS loaded in either CH or PLA alone in a rat femoral implant-based osteomyelitis model. Blood samples were collected to measure haptoglobin, an inflammatory marker, through four weeks post-treatment. Radiographic images were taken as another longitudinal measure of disease. Four weeks post-treatment, bone and surrounding soft tissue were harvested to quantify colony-forming units (CFUs). Haptoglobin concentration was reduced on days 21, 28, and 35 from days 8, 10, and 14. Haptoglobin concentration was reduced with all three FOS containing groups compared to blank CH. Radiographic analyses showed defect area at day 35 was lower in CH-FOS and CH-FOS + PLA-FOS groups compared to blank CH. Compared to blank CH, only CH-FOS + PLA-FOS reduced bacteria in soft tissue, while all FOS treatments reduced bacteria in bone. In conclusion, FOS was effective at preventing defect area increase, and reduced both the acute phase immune response and bacterial burden in bone and soft tissue.

230

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Major: Wildlife, Fisheries & Aquaculture

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Funding: College of Forest Resources URSP

Survival and Recruitment of an Adaptive Songbird in an Urbanized Landscape

Life cycles of songbirds in urban environments and the effects of urbanization on ecosystem structure and function have received limited attention. Common species, such as the Northern Mockingbird (*Mimus polyglottos*), may be experiencing declines where ancillary research posts apparent adult survival for this species at 36%. We combined mark-recapture observations to evaluate survival and productivity of Northern Mockingbirds across Mississippi State University's campus with intent to qualify this population as a potential source (replacing breeding adults given potential annual mortality) or sink. We located 9 accessible nests, then banded and collected morphological data on 26 chicks. We observed each nest every other day to determine nest survivorship. We also observed each chick every other day post-fledging to estimate apparent survival during a 26-day period initiated post-fledging. Estimates from our nest survival model, assuming a 24-day period from egg-laying to fledging, revealed the average probability that a nest fledged young was 22% (95% CI: 5 – 46%). Average apparent survival of young once fledged was 4% (95% CI: < 1 – 46%). Despite what appears to be an abundance of Northern Mockingbirds on Mississippi State University's campus, results from our analyses indicate that at least during 2022, and given only appreciation for the nesting and post-fledging period, MSU's campus does not produce young sufficient to replace breeding adults assuming apparent mortality is 36%. With future geospatial analysis, we hope that this data will allow us to assess how we can best support songbirds within an urbanized landscape such as MSU's campus.

231

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Funding: College of Agriculture and Life Sciences URSP

Design, prototype, and evaluation of a low-cost multimodal device for cardiovascular monitoring

Cardiovascular diseases (CVDs) are the leading cause of death in the United States. In most cases, these diseases go undiagnosed and untreated in the general population until the patient's health is severely affected. In that regard, the availability of a low-cost monitoring device can help in the early detection and management of cardiovascular diseases. The goal of this pilot study is to construct and establish the feasibility of an inexpensive sensing device that is noninvasive and can be used to monitor cardiovascular activity outside of healthcare facilities. This device includes an MPU-6050 inertial measurement unit, an AD8232 signal conditioning block, a MAX30102 sensor, and a microcontroller to measure triaxial seismocardiogram (SCG), triaxial gyrocardiogram (GCG), electrocardiogram (ECG), and the oxygen level of the blood. The sensors were enclosed by a 3D-printed custom-designed case. To evaluate the performance of the device, five healthy adult subjects have been recruited after institutional review board approval. The subjects were asked to lay in supine position and breath normally during the experiment. The prototype was placed on subjects' chests to acquire their SCG, GCG, and ECG signals, as well as the blood oxygen level with a sampling frequency of 200 Hz for 2 minutes. The ECG electrodes were placed under the right clavicle, left clavicle, and the lower right side of the abdomen. The signals of interest were also measured simultaneously using more sensitive, expensive, and commercially available sensors (as the gold-standard). The signals collected from the prototype were then compared to the gold-standard signals that were down-sampled to 200 Hz. Results demonstrated a good correlation between the two groups of signals in time and frequency domains, proving the feasibility of the proposed multimodal device. This device will ultimately provide an inexpensive and noninvasive method of scanning for CVDs in the general population.

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Name: Sampson, Rachel

Major: Architecture

Faculty Advisor: Aaron White, Architecture

Stylistic Analysis: Saint Peter's Façade Explored

This study takes the form of a paper in which the façade of Saint Peter's Basilica, as viewed from Saint Peter's Square, is analyzed from a stylistic perspective. The analysis is completed by referencing the format described by Meyer Schapiro in his writing "Style". This format allows the viewer to assess a building's style through its elements, relations, and qualities. Through elements, the details and ornamentation of the façade are examined. Starting in the center and moving outwards, details like columns, doorways, and windows, and ornamentation like carvings in the stone are analyzed. Through relations, the connection of the elements to each other is analyzed. By taking a step back to observe how the elements examined closely work together on the façade of the building. Finally through

qualities, the façade as a whole is explored. This includes the monumental impact the face of the building leaves on viewers, and how it is a representation of what is to come on the inside. This analysis does not assign a historical label to the style of St Peter's Basilica, instead focusing on the formal expression of the façade individually.

37

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Co-Author(s): Ronald Unz, Benjamin Crider, Matt Wright, Sam Lusby, Adam Randle, Jay McCown, Jaime Rickert

Automated Radiological Data and Mapping Analysis Software

The Institute for Clean Energy Technology (ICET) has developed semi-autonomous robotic survey systems that are essential in identifying, analyzing, and remediating radiological contamination without human exposure to hazardous radiological materials during site remediation and decommissioning activities. Although these systems collect radiological survey data, post-survey data analysis can be time-consuming and tedious, requiring human manipulation to create functional radiation field maps. This scope of work describes the processing of raw robotic data using Python-based code and Seequent's Oasis Montaj software, an advanced suite of geophysics modeling and analysis tools to automate this analysis process. The tool described generates a functional heat map that provides insights into the contamination distribution, streamlining the remediation and decommissioning process. The all-in-one semi-autonomous survey system and the described visualization mapping software enables the surgical removal of radiological contamination. By automating the data analysis process, this work increases the efficiency of radiological survey data processing and facilitates the safe remediation of contaminated areas, and reduces the amount of radiological waste.

232

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Funding: College of Agriculture and Life Sciences URSP

Assessing the influence of biogeography on soil microbial communities using Biolog EcoPlate assay

Soil microbial communities are the foundation of soil ecological function, playing a key role in sustaining and facilitating the geochemical cycles and soil mineralization. Microbial communities differ substantially between the soil types and under different land management systems. It is crucial to understand the functional diversity of soil microbial communities which help in revealing the soil-plant-microbe relationship, thus promoting the early seedling establishment and growth. We explored the carbon source metabolic activity and functional diversity of microbial communities using the Biolog EcoPlate assay containing 31 types of carbon sources. In this study, fourteen soil samples with different soil characteristics were collected across the state of Mississippi. Sample locations were chosen with a wide range of natural and cultivated systems, including farms, forests, Prairies, edge of the abandoned lime pit, parent materials, slope classes and undisturbed lands. The community level Physiological Profiles differed significantly across the soil samples. The Shannon diversity, Shannon evenness and McIntosh index were significantly higher in the S11 (Ripley Parent Material, unnamed) compared to other samples which were due to higher substrate richness in the S11 sample. Average well color development (AWCD) after 96 hours of incubation showed that samples, S2 (Undisturbed soil), S3 (Cottonwood plantation soil), S4 (Houlka Creek alluvium), S6 (farmed soil) and S11 had significantly greater utilization rates of carbon sources than the other samples. Phenolic acids>Amines>Polymers were the major carbon sources metabolized by microbes in these soil samples. These results suggest that different land-use types had a significant influence on the carbon sources metabolized by the soil microbiota which might be due to the influence of environmental factors and soil physiochemical properties.

65

Name: Saucier, Jason

Major: Landscape Architecture

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Funding: College of Agriculture and Life Sciences URSP

The Functioning and Organization of Student Farms in the United States: Developing a Student Farm at Mississippi State University

There are many universities across the United States that have adopted student farms on their campuses. Student farms are designed to enhance student educational experiences, provide campus job opportunities, and provide natural food resources to the campus. Student farms can be used by classes within agriculturally based settings, student service projects, student jobs or internships, university

extension services, research projects, and general plant production experiences. Student farms originated from the Manual Labor Movement in the nineteenth century that allowed physical labor on farms to be implemented on academic grounds (Goodman 1993, p. 355-388). Student farms have further been developed and used by Land Grant Universities, as well as other institutions. Within the last several decades, student farms have increased across the United States, as more universities and student bodies have begun to focus more on sustainable living and healthier lifestyles. With the use of student farms, programmatic elements within the farm site are used to attract students to the farm- which can ultimately lead to student involvement. Based upon Kolb's Experimental Learning Theory, it is proven to show that "knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience" (Kolb 1984. p. 41). Student farms can be a tool for better agricultural learning due to the link of hands-on experience to classroom learning. The design and functionality of a student farm is dependable on location and intended use of the farm. Student farms across the United States perform based upon their intended usage which may include vegetable production, research, outdoor learning, medicinal plant production, and bee farming. The intended use of the found research is to determine the greatest solution to the design, functionality, and management of a student farm on the given amount of two acres.

131

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Funding: ORED Undergraduate Research Program

Adapting the Household Hunger Scale to Collect Individual- and Household-Level Data on Food Insecurity in Rural Zambia

Introduction: Leading development organizations—including the United States Agency for International Development (USAID) and UNICEF—report that poverty, food insecurity, and child malnutrition remain high in Zambia, and the country's rural poor are particularly vulnerable. Methods: We adapted Ballard et al's (2011) previously validated Household Hunger Scale into the Household Hunger Scale II, which we administered to 484 heads-of-households in vulnerable rural communities in Zambia's Southern Province. The original scale collapsed individual- and household-level responses for three Hunger Events (HEs) experienced in the past four weeks. For the new scale, we separated individual- from household-level responses for four HEs experienced in the past four weeks, including: HE1) How many meals did [you][other household member/s] miss due to a lack of food or resources to get food?; HE2) Was there ever no food to eat in your dwelling due to a lack of resources to get food?; HE3) Did [you][other household member/s] go to sleep at night hungry because there was not enough food?; HE4) Did [you][other household member/s] go a whole day and night without eating because there was not enough food? For all HEs, any experience in the past four weeks is scored as follows: 1-2 times = occasional hunger, 3-10 times = moderate hunger, >11 times = severe hunger. Results: 52% of individuals and 45% of households experienced occasional, moderate, or severe hunger as defined by HE1; 37% of households experienced occasional, moderate, or severe hunger as defined by HE2; 35% of individuals and 31% of households experienced occasional, moderate, or severe hunger as defined by HE3; 13% of individuals and 11% of households experienced occasional, moderate, or severe hunger as defined by HE4. Discussion: Disaggregating individual- from household-level data provides a more fine-grained snapshot of food insecurity in this sample of vulnerable individuals and their households.

132

Name: Schambeau, Hartleigh

Major: Kinesiology

Faculty Advisor: Chih Chia Chen, Kinesiology

Does Volleyball Training Enhance Volleyball Skill Acquisition and Transfer of Learning in Badminton for Adults with Intellectual Disabilities?

PURPOSE / AIM: People with Intellectual disability (ID) have difficulties in the elaboration of motor programs. The purpose of this study was to determine whether adults with ID could acquire volleyball individual skills via an integrated volleyball program and, further, transfer the learned skills to badminton performance. METHODS: Ten adults with ID (7 males, aged 18-20 years) with little or no experience in volleyball and badminton and six adults without ID (6 females, aged 20-22 years) participated in an integrated volleyball program. Participants practiced volleyball skills, game awareness, and rules for 50-min each session, twice a week for 8 weeks. Volleyball (e.g., setting, passing, and serving) and badminton (hitting, forehand underhand stroke, forehand overhand stroke) skills were measured before and after the program. A Pearson product-moment correlation was utilized to explore the relations between volleyball and badminton skills. A 2 (time: pretest and posttest) x 2 (groups: ID and non-ID) ANOVA was used to evaluate the learning effect on their skill acquisition and transfer. RESULTS: The performance between volleyball and badminton was significantly associated among participants. Adults with ID significantly improved their volleyball setting skills after training. In addition, A conventional level of significance was noted in badminton forehand overhand stroke. Nevertheless, no improvement was found in adults without ID. IMPLICATIONS / CONCLUSION: Volleyball and badminton may share similar movement parameters. Adults with ID seemed to have the ability to retrieve motor programs and transfer them into a new situation. The same learning process was not seen in adults without

ID due to their past relevant training experiences. Our findings may reveal a possibility to apply the principle of motor learning in exercise programs for people with ID.

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Name: Seiler, Gavin

Major: Cyber Security & Operations

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Co-Author(s): Chris Greene, Teddy Lander

Funding: NCAE-C

Security Risk Assessment Tool Project

Small businesses around the US are experiencing a major problem with maintaining good cyber hygiene. It is one thing to implement good cyber hygiene but maintaining it is becoming increasingly more difficult. Small businesses do not always have a technical technician on the pay roll. They often must hire outside entities to come setup their network and/or fix their network when something goes wrong. One of the biggest problems is determining how secure a company is once an assessment of their company security is complete. No one can be fully secure, but are they at least minimizing the risk for an attack? We are working with Florida A&M University (FAMU) to research what has been done and fill a knowledge gap in this area of research. In the past we have researched using an assessment report tool called CSET but found several problems using this method. The Center for Cyber Innovation has created a tool called NetMapper that can scan a network and provides detailed information about the network and each node on that network. We believe we can perform an automatic assessment of a given network using the extracted network information provided by NetMapper. We believe we can perform this assessment by leveraging the NVD database and the NIST security standards, more specifically the CMMC 2.0 standards. With this given information, we intend to show we can produce a final assessment report. We propose a concept leveraging the NVD database to evaluate a company's risk assessments to provide a security risk score report. This would help management and their IT better understand and mitigate risks to their company.

233

Name: Seo, Clare

Major: Microbiology

Faculty Advisor: Justin A. Thornton, Biological Sciences

Co-Author(s): Chaeyoung Kim, Keun Seok Seo, Joo Youn Park, Nogi Park, Youngkyung Park

Funding: NIH-R15, Rational design of pneumococcal vaccine

Development of pneumolysin-neutralizing vaccine inducing mucosal immunity for protection against invasive disease

Streptococcus pneumoniae (Spn) is a significant human pathogen causing minor infections including otitis media, and severe diseases including meningitis and pneumonia, which are responsible for 100,000-500,000 deaths of children aged <5 yr. Although polysaccharide capsule-based conjugate vaccines successfully provide protection from pneumococcal diseases, infection with non-vaccine capsule types has increased and requires new vaccine strategies that provide protection against all capsular types of Spn. Pneumolysin (PLY), is a highly conserved, pore-forming toxin, which plays an important role in penetrating mucosal membranes to cause lethal pneumococcal septicemia and meningitis. Thus, we hypothesize that a PLY-neutralizing vaccine, inducing mucosal immunity, would prevent Spn from causing invasive disease. Mucosal immunity is mainly mediated by secretory immunoglobulin A (sIgA), which neutralizes invading pathogens at the mucosal membrane. To develop a vaccine-inducing mucosal immunity, we used western blotting to screen human serum that naturally developed IgA response to *Staphylococcus aureus* (SA) antigens. All tested serums commonly showed a very strong IgA response to a 67kDa-SA antigen, indicating it could serve as a vaccine adjuvant candidate. To develop a PLY-neutralizing vaccine antigen, we generated a recombinant protein containing the C-terminal D4 domain of PLY (PlyD4), that binds to membrane-associated cholesterol, leading to pore formation. Immunization with PlyD4 and 67kDa-SA antigen induced significantly higher serum IgA and IgG titers than PlyD4 alone. Serum immunized with PlyD4 and 67kDa-SA antigen successfully neutralized Ply cytotoxicity against human pharyngeal epithelial cells. In challenge experiments, three out of four animals immunized with PlyD4 and 67kDa-SA antigen not only survived but also completely cleared intranasal Spn infection, while three out of four animals immunized with PlyD4 alone succumbed to infection. Our results suggest that 67kDa-SA antigen is an ideal vaccine adjuvant to induce mucosal immunity for protection against Spn infection.

234

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Major: Geoscience

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Funding: Southern Sustainable Agriculture Research and Education (SARE) On-Farm Grant

Evaluating The Effectiveness of Cover Crops on Soil Respiration

Cover crops are crops planted in the non-growing season to help retain the soils health characteristics. The effect of cover crops on soil respiration, bulk density, microbial biomass and soil organic carbon in two farms in the Mississippi Delta were evaluated in this study. Two farmers took part in this experiment and each had one field with cover crops and another field without cover crops, which allows for us to see the difference in the selected parameters. Soil samples were collected from these farms before seeding and after harvest of cash crop. Preliminary results indicate that not much change is occurring in the microbial biomass between the 1st and 2nd samples, this differs from the soil respiration in which the cover crops helped to increase the rate of respiration while the plots with only cash crops had a decrease in respiration. The plots with the cover crops had a majority of the samples fall into the medium-low activity level of respiration, while the cash crop only plots have a majority in the low activity level. The difference in these levels is attributed to the biological activity with their availability to the carbon around them, while the microbial biomass tests give an idea of how many microbes are in each soil sample. The consistency of the microbial biomass in the tests with respect to the difference in carbon respiration rates for these organisms is a good indicator to help determine the effect of cover crops on soil health. In conclusion, while it is still early to say for certain if cover crops help the overall soil health during non-planting seasons, it is safe to say that it cover crops do increase the availability of carbon for the microbial biomass present

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Funding: College of Agriculture and Life Sciences URSP

Students rule, researchers drool: implementing a long-term course project for assessing wild pig ecological impacts

Wild pigs (*Sus scrofa*, hereafter pigs) impact vegetation throughout much of the southeastern U.S. between rooting and wallowing behaviors. Previous studies have been conducted on these impacts. However, none have occurred in Mississippi, and few are long-term studies. Additionally, none of these studies incorporate the research and data collection as an experiential learning opportunity for college students. Therefore, we sought to understand the effects of pig wallowing and rooting on understory plant composition and structure at the Sam D. Hamilton Noxubee Refuge just south of Mississippi State University (MSU). Sampling protocols were developed to characterize plant communities according to predicted pig effects and implemented during class lab sections for students enrolled in an undergraduate wildlife plant identification course at MSU. We arranged 14 clusters, each composed of 3 exclosures and an open reference site, in randomly selected locations within the refuge. Exclosures encompassed wallows, rooting areas, or undisturbed references and simulated pig eradication. Student groups were tasked with following a single sampling protocol per cluster and lab day. The groups switched protocols weekly such that each group could learn and experience every protocol. Any remaining clusters after lab were sampled by another sampling team, and one cluster was resampled by a graduate student class to assess sampling bias. Preliminary results from characterizing clusters suggests similar basal areas, canopy coverage, and horizontal plant coverage among clusters. Woody stem density, measured within each exclosure, decreased slightly from undisturbed areas to wallows and rooting exclosures. Plant coverage results within exclosures will be presented as well. Minimal differences among clusters were expected considering wild pig impacts on understory plant communities were more likely (i.e. within exclosure). However, future semesters of sampling will likely observe a divergence between exclosures and surrounding areas as pigs continue to disturb the ecosystem.

133

Name: Shike, Zachary

Major: Psychology

Faculty Advisor: Andrew F. Jarosz, Psychology

Keeping an Eye on the Problem: Using an Eye-tracker to further test the Inconsistent Operations Hypothesis

Word problems are amongst the most difficult types of solvable math problems due to the extra information that can distract one from solving a problem. Past research has explored whether this difficulty derives from numerical interference, as predicted by the foregrounding hypothesis, or linguistic interference, as suggested by the inconsistent operations hypothesis. The foregrounding hypothesis states that the difficulty is caused by irrelevant numbers in the problem that confuse the participant. For example, in the word problem, "John drops 5 apples as he walks through a grove. If John walks past 3 rows of 10 trees, how many trees did John pass?" the number "5" may cause numerical interference. However, the inconsistent-operations hypothesis states that the difficulty is caused by the irrelevant *language*. In the same example, the linguistic interference would be "drops," which might prime the incorrect mathematical operation (e.g., subtraction). The present studies further explore these hypotheses by introducing an eye tracker. Across both studies, participants solved multiplication and division problems that included distracting information, which was either associated or disassociated to the protagonist of the word problem. In the first study, a potentially distracting word or number was placed in the first sentence of the problem, that either associated or disassociated the number with the protagonist. In the second study, the numbers were removed and replaced with non-numerical words. If the inconsistent operations hypothesis is true, then the participants will spend

more time fixating on the distracting word rather than the distracting number and there will still be an effect when the numerical interference is removed. Understanding the results from this research can help explain not only why these problems can be hard for students, but to better equip teachers with the tools to make problems more comprehensible.

39

Name: Shy, William

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Co-Author(s): Ryan Gaynor

Funding: NIH

Bio-inspired Polyimidazole Manganese Chelators

The immune system contains many metal-ligand complexes in the form of metalloproteins, which work to sequester vital metals from invasive pathogens. These complexes are tuned to bind specific metal ions, and different proteins are configured differently to bind certain metals with high affinity and selectivity over other metals. One important metal is manganese, which usually exhibits low selectivity over other metal ions. However, the protein calprotectin binds Mn²⁺ with unusually high affinity. In this research, a hexadentate, trisimidazole ligand based on a 1,4,7-triazocyclononane (tacn) ring was synthesized to model the hexahistidine binding site of calprotectin. We made several different forms of this ligand with varying degrees of steric bulk at the imidazole substituents to alter the cavity size, hypothesizing that varying the cavity size could help select for metal ions of different sizes. The effects of this steric bulk were tested against important factors in metal ion selectivity such as cavity size, binding constant, and redox potential to understand calprotectin's high affinity and selectivity for manganese. It was found that although the ligand still favors binding zinc over manganese, increased steric effects resulted in a larger cavity, and manganese was much more competitive in binding the larger-cavity ligands. Additionally, the cavity size was found to affect the redox potentials of the manganese complex, which has inspired further work, using cobalt instead of manganese. Steric and electronic effects on the redox and spin-state properties of the cobalt complex will be investigated. This has potential applications in designing redox-sensitive MRI probes.

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Name: Simpson, Austin

Major: Wildlife, Fisheries & Aquaculture

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Funding: College of Agriculture and Life Sciences URSP

Assessing the Effect of Egg Retention on Egg Quality and Fertilization Potential in *Ambystoma tigrinum*

Conservation efforts rely heavily on captive breeding programs (CBPs) to maintain genetically diverse amphibian populations. Unfortunately, low fertilization rates are often observed in CBPs, and may be related to egg quality. Research in other taxa has shown that matured eggs retained within the female reproductive tract may degrade over time, becoming less receptive to fertilization. To assess the effects of retention on egg quality, we measured the abnormality and fertilization rates of eggs retained for 3 months and compared them to freshly recruited eggs in tiger salamander (*Ambystoma tigrinum*) females (n=4). Ultrasonography was used to track follicular development and monitor the time matured eggs resided in the reproductive tract. After matured eggs were observed for 3 months, females were administered an ovulatory hormone dose of 0.1 µg/g body weight (BW) gonadotropin releasing hormone + 4 IU human chorionic gonadotropin/g BW. In-vitro fertilizations (IVF) were performed using freshly collected sperm with an average total motility of 73%. Ultrasonography was applied following the IVF to track the next cycle of follicular recruitment. As soon as matured eggs were observed, IVFs were immediately repeated as described. Egg abnormalities and fertilization rates were recorded following IVF and compared with eggs retained for 3 months. Linear mixed modeling was used to determine the difference in egg abnormality and fertilization rates between retained and non-retained eggs. Results showed that the number of abnormal eggs in clutches of retained eggs (20.3±13.4%) was lower than the number of abnormalities in clutches of non-retained eggs (32.3±17.7%); however, the difference was not significant (p=0.39). Fertilization rates were lower for retained eggs than non-retained eggs, yet the difference was not significant (p=0.68; retained: 3.6±1.9%; non-retained: 9.50±3.8%). Overall, there was a trend toward egg retention negatively affecting fertilization rates, which could provide potential evidence for low fertility success within salamander CBPs.

52

Name: Singleton, JaKara

Major: English

Faculty Advisor: Lynn Holt, Philosophy

World Building: Exploring the Didactic Relationship Between Reality and Video Games

Using Harry Berger's theory of the three worlds, I will be analyzing the video game *God of War: Ragnarök*. My scholarship focuses on the didactic relationship between the first and green world. The first world as reality becomes mirrored through artistic interpretation such as literature, cinema, or video games, which becomes a green world. Berger describes the green world as a place that "provides a temporary haven for recreation or clarification, experiment or relief. . . . it projects the urge of the paralyzed will to give up, escape, work magic, abolish time and flux and the intrusive reality of other minds." Any fictional narrative with a moral purpose can be described as a green world. While other modes of storytelling such as literature or cinema can present one with a moral purpose, there exists a barrier between the actions on the page or screen and the reader or watcher. The video game provides the player agency within the narrative by having them perform the action within the story. My presentation will focus on the Draupnir Spear as a metaphor that acknowledges the didactic relationship between the first and green worlds. In the first world, the spear references the past *God of War* games when Kratos had a larger weapon arsenal than the current reboot. *God of War* (2018) featured only two weapons, while the earlier trilogy had multiple weapons the player could choose from throughout the game. The Draupnir Spear also references Kratos' past in the *God of War* narrative. After his blacksmith compliments his use of the spear, Kratos remarks that "It is the first weapon a Spartan learns," and the other two characters present note the foreboding significance of him mentioning his past as a Spartan.

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Name: Sloan, Jessie

Major: Educational Psychology

Faculty Advisor: Kasia Gallo, Counseling, Educational Psychology, and Foundations

The Effect of Gender and Gender Stereotyping on Beliefs about Women in Church Leadership

The present research study examines the effect of gender and gender stereotyping on people's beliefs about women in church leadership. Previous research has shown that female church leaders face obstacles to their leadership from gender stereotyping. This study examined the general person's understanding and recognition of the obstacles that women in church leadership face. Participants were 114 college students at Mississippi State University. Participants came from various Christian and non-Christian backgrounds and consisted of 80 women, 33 men, and one nonbinary participant. Each participant was sent an online link to the research survey. This survey contained a demographic questionnaire, the Stereotyped Beliefs About Women as Pastors inventory, and the Ambivalent Sexism Inventory. The results of statistical analyses suggest a significant correlation between people's beliefs about women in ministry and their gender and sexist attitudes. Females were significantly more likely than males to have positive beliefs about women in ministry and to recognize the challenges that these women face ($t = -3.332, p < .001$). Sexism was further defined and measured as hostile and benevolent sexism. Hostile sexism is the actions and attitudes about an individual based on their gender that is negative and harmful in nature and intent (Glick & Fiske, 1996). Benevolent sexism is actions and attitudes about gender that are still based in stereotypical beliefs but that come across as beneficial in nature. Both hostile sexism ($r = -.348, p < .001$) and benevolent sexism ($r = -.345, p < .001$) decreased as beliefs about women in ministry became more positive. This research demonstrates the complex relationship around beliefs about women in church leadership. To create a more equitable field for women in church leadership, a multi-pronged educational approach must be implemented that takes into consideration people's gender and the gender stereotypes that they hold.

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Name: Smart, Eli

Major: Biochemistry

Faculty Advisor: Seung-Joon Ahn, Biochemistry, Molecular Biology, Entomology, and Plant Pathology

A novel rearing system of the plastic-degrading beetle (*Zophobas morio*)

The superworm is the larval stadium of a species of darkling beetle (*Zophobas morio*), which is known in industrial entomology as an efficient converter of organic side-streams, making it a useful tool in the construction of circular economic strategies. It is also a highly nutritious organism, containing many essential amino acids and a large amount of nitrogen. However, one of the most fascinating and intellectually stimulating properties of the superworm is its ability to successfully digest and derive energy from polystyrene, a highly stable, hydrophobic plastic polymer. While polystyrene does not provide any nutrients for superworms, it does suggest the possibility of discovering an enzymatic pathway capable of degrading the plastic. It is currently believed that symbiotic bacteria such as *Priestia megaterium* reside within the digestive tract of the superworm and secrete an extracellular hydroxylase that is capable of destabilizing benzene moieties in the structure of polystyrene. To further investigate this biodegradative pathway, it is necessary to develop an effective rearing method of the superworms in a laboratory condition, thus lowering the barrier to entry for laboratories to conduct research with this organism. To this end, we have developed a three-shelf rearing chamber with improved airflow to prevent mold growth and a mesh bottom for the topmost shelf to allow eggs to fall from the adult breeding chamber, preventing cannibalization. We have also refined methods for feeding, hydrating, temperature and humidity controls, and preventing the spread of entomopathogenic fungi. It will pave the way for further research on metagenomics and transcriptomics to investigate the polystyrene biodegradation by the superworm and its consorts.

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Name: Smith, Adelle

Major: Human Development & Family Science

Faculty Advisor: Lori Elmore-Staton, School of Human Sciences

Co-Author(s): Alisha Hardman

Funding: Mississippi Department of Human Services

Evaluation of Knowledge and Skills Gained Through Positive Guidance Parenting Toolkits for Mississippi Families

The Trauma Informed Parenting and Professional Strategies (TIPPS) Extension program is a two-pronged approach to reduce child maltreatment and enhance trauma-informed care practices among professionals working with children and families. The parent facing side of TIPPS, Protect and Connect, focuses on providing caregivers with developmental research to support them in creating safe, stable, and nurturing relationships and environments. Families are mailed three parent education toolkits. This study examined the effectiveness of the "positive guidance" toolkit in promoting parental knowledge and skills across six domains (i.e., (1) nurturing parenting practices (2) safety threats and protection strategies (3) positive guidance (i.e., discipline) strategies (4) family stress and conflict management strategies (5) practices to promote child development and (6) co-parenting strategies.) In this toolkit, families received items that explained positive discipline strategies at different developmental levels and ways to promote a growth mindset. The sample included families from Mississippi (N = 1403) with children aged 0-18. The data represented here reflect the reports of those who completed evaluations of the toolkit (N = 670). The evaluation method used was a modification of the MSU Extension standardized program evaluation that specifically asked about increases in knowledge or skills in each of the six domains. Participants answered questions via phone and/or a Qualtrics link and were required to select the degree of change using a 5-point scale (i.e., strongly disagree = 1 to strongly agree = 5). Parents reported enhanced knowledge across 6/6 of the domains and increased skill across 6/6 domains. Data showed that for this toolkit, parents reported the highest increase in knowledge and skill in both positive guidance (M = 4.23, SD = .760) and nurturing parenting practices (M = 4.32, SD = .745). Overall, the positive guidance toolkit was effective in promoting safe, stable, nurturing relationships and environments.

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Name: Smith, Makayla

Major: Sociology

Faculty Advisor: Kathleen Ragsdale, Shackouls Honors College

Funding: United States Agency for International Development (USAID)

FishFirst! Zambia Nutrition-Related Activities: Encouraging Fish Consumption Among Vulnerable Mother-Infant Dyads at Lake Kariba.

Introduction: FishFirst! Zambia's name is derived from the project's goal to promote the consumption of fish—particularly species of whole small fish—among women of reproductive age and vulnerable infants and young children in the "First 1,000 Days of Life." This time period—from conception to 2 years of age—encompasses infants and young children's (IYC) transition from exclusive breastfeeding to consuming solid foods that are part of their family's regular diet. This transition has been identified as critical for vulnerable IYC who can become severely malnourished during weaning (e.g., stunted, anemic). While Lake Kariba's nutrient-dense, small fish known locally as Kapenta can fill protein and micronutrient gaps among vulnerable IYC in food-insecure families, many small-scale fishing households at Lake Kariba sell all or most of every Kapenta catch. Methods: To encourage the consumption of Kapenta among IYC and their families at Lake Kariba, we engaged mothers in nutrition training, cooking demonstrations, and two separate sensory panels to increase mothers' knowledge of 1) Kapenta's nutritional benefits; 2) how to use dried Kapenta to produce a highly palatable dried-fish powder (DFP) at home; and 3) how to use this DFP to fortify traditional foods for IYC and the entire household that are both tasty and nutritious. Results: Over three days, mother-infant dyads (N=84) participated in the following four activities: 1) an interactive 3-hour nutrition training; 2) hands-on cooking demonstrations using DFP; 3) a sensory panel wherein mothers evaluated four DFP-fortified traditional foods; and 4) a sensory panel wherein mothers evaluated whether their 6-23 month-olds found DFP-fortified complementary porridge acceptable. Discussion: Continued educational outreach and knowledge transfers for resource-limited mothers at Lake Kariba are vital to encourage home production and household consumption of nutrient-dense DFP among vulnerable IYC and other family members within small-scale fishing households.

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Name: Smith, Owen

Major: Industrial Engineering

Faculty Advisor: Wenmeng Tian, Industrial and Systems Engineering

Co-Author(s): Abdullah Al Mamun

Funding: Shackouls Honors College Research Fellowship

Metal FFF Quality Assurance and Certification Based on In-Situ Layer-wise Image Analysis

The usage of metal fused filament fabrication (FFF) has become an increasingly popular trend in the field of additive manufacturing (AM). This is due to the extreme flexibility that FFF provides in terms of both material composition and part designs. Furthermore, it also holds advantages in its low equipment cost and high energy efficiency when compared to other AM processes, making it a most desirable option in applications such as rapid tooling and prototyping. However, the metal FFF processes involve multiple stages of operations, including materials preparation, fabrication, and post-treatment, where the process variation is still not sufficiently understood. Therefore, there is an urgent need in process monitoring and certification for the metal FFF processes to assure the final product quality. This study establishes an in-situ layer-wise process monitoring method for the metal FFF process. A layer-wise inspection routine was integrated into the 3D printing process, where in-situ layer-wise images can be captured for printing quality characterization. Subsequently, an image processing scheme provides layer-wise characterization in terms of area of porosity. Furthermore, the variation of area was examined when the process variable changes in the analysis of variation (ANOVA) framework.

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Name: Smith, Sage

Major: Landscape Contracting

Faculty Advisor: Bi Guihong, Plant and Soil Sciences

Co-Author(s): Tongyin Li

Funding: College of Agriculture and Life Sciences URSP

Growing Ginger and Turmeric in Mississippi

Ginger and Turmeric are widely used spices known for their anti-inflammatory, antioxidant, and anti-cancer properties. In recent years, the demand for locally-grown culinary herbs and spices has been growing due to increasing awareness of their health benefits. This creates a niche market and provides opportunities for local growers. While ginger and turmeric are primarily produced in countries like India, the subtropical climate in Mississippi is suitable for growing ginger and turmeric. However, there is limited information available on the production of ginger and turmeric in MS. To address this gap, this study aimed to investigate the feasibility of growing ginger and turmeric as alternative crops for specialty crop growers in MS. Rhizomes of one ginger cultivar 'Peruvian Yellow Ginger' and three turmeric cultivars 'Indira Yellow', 'Red Hawaiian', and 'White Mango' were grown in 3-gallon containers filled with Metro-Mix® 852 substrate and supplied with either organic fertilizer Gardentone 3-4-4 or conventional fertilizer Osmocote® Plus 15-9-12. The plants were placed under 40% shade cloth and irrigated through drip irrigation. Plant growth were monitored during the growing season, and the plants were harvested in November before the frost. Rhizome fresh weight and dry weight were recorded. The results showed that ginger and turmeric plants can grow well in MS. For both ginger and turmeric, plants that received conventional fertilizer produced a higher yield of rhizomes compared to those treated with organic fertilizer. For turmeric, in general, cultivars 'Indira Yellow' and 'White Mango' produced a higher yield of rhizomes compared to cultivar 'Red Hawaiian'. These findings suggest that there is great potential to grow ginger and turmeric as alternative crops in MS.

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Name: Snell, Katherine

Major: Biochemistry

Faculty Advisor: Mary E. Dozier, Psychology

A Narrative Review into the Relationship between Traumatic Life Events and Hoarding Disorder

Hoarding Disorder (HD) is categorized by persistent difficulty discarding or parting with possessions, regardless of their actual value. Hoarding was once categorized as a subset of obsessive-compulsive disorder (OCD) but has since been codified as its own disorder. As a relatively new disorder, its causes are not entirely known, although multiple studies and articles have been published investigating this topic. The current study was a literature review of traumatic life events (TLE) and their prevalence within hoarding disorder. Only articles that included samples of participants with hoarding symptoms, whether in the context of OCD or HD, were used in the review. The articles must also have screened for TLE in some way, most usually by oral interviews given by participants. Thirteen articles were selected for the study, but only six provided valuable insight into the question of the relationship between TLE and HD. Individuals with hoarding disorder experienced more TLE, especially in regards to sexual and physical abuse. Because of this, it is speculated that because of this abuse, individuals with hoarding symptoms will feel safer around objects as opposed to people. This is supported by the fact that among the three factors of HD (clutter, acquisition, and discarding), clutter was most strongly associated with traumatic events. Separate from TLE, a low level of distress tolerance also plays a factor in hoarding disorder. Based on these findings, there may be a relationship between the presence of TLE and a low distress tolerance (DT). This literature review was limited by the participants used, as almost all of them used participants with pre-existing OCD. The presence of depression, anxiety, and/or PTSD could have also played a role in TLE and DT. Further research needs to be conducted that analyzes the relationship between HD and low DT, while controlling for depression and anxiety.

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Name: Sotak, Susan

Major: Animal and Dairy Science

Faculty Advisor: Shengfa F. Liao, Animal and Dairy Sciences

Co-Author(s): Emmanuel Oladejo

Funding: College of Agriculture and Life Sciences URSP

Effect of dietary supplementation of MHA-Ca vs. DL-methionine on intestinal mucin gene expression upon oxidative stress in growing pigs

Methionine (Met) is the second or third limiting amino acid in typical swine diets, and its exogenous supplementation may improve intestinal health. This study focused on examining the effect of dietary supplementation of DL-Met vs. MHA-Ca (a Met hydroxy analog) on the intestinal mucin gene expression in growing pigs. Twenty barrows (21.8 ± 5.72 kg) were randomly allotted to 4 treatment groups ($n=5$). While Groups 1 and 2 received a basal diet (Diet 1), Group 3 received a DL-Met supplemented diet (Diet 2) containing 125% SID Met+Cys of Diet 1. Group 4 received a MHA-Ca supplemented diet (Diet 3) in which MHA-Ca quantity was $1.54 \times$ DL-Met in Diet 2. After 3 weeks of feeding, pigs were injected with either 10 mL saline (for Group 1) or 10 mg/kg-BW diquat in 10 mL saline (for Groups 2, 3 and 4). By the end of week 4, pigs were euthanized, and the ileal mucosa was sampled. Real-time qPCR was conducted for the abundance of integrity associated marker genes (including MUC-1, -2, and -4). Data was analyzed using Student's t-test and groups compared were: Group 2 vs 1, Group 3 vs 2, and Group 4 vs 3. The mRNA level of MUC-1 in Group 2 was lowered ($P < 0.05$) relative to Group 1. While MUC-1 was upregulated ($P < 0.05$) in Group 3 relative to Group 2, MUC-2 and MUC-4 in Group 3 were not different from Group 2. While MUC-1 in Group 4 was lowered ($P < 0.05$) relative to Group 3, MUC-2 tended to be downregulated ($P = 0.07$). This study suggested that oxidative stress impairs intestinal mucin gene expression, more dietary DL-Met supplementation maintains mucin gene expression in these oxidatively stressed pigs, and MHA-Ca is not as effective as DL-Met in maintaining the intestinal mucin gene expression of the oxidatively stressed pigs. **Keywords:** Methionine, Intestine mucin gene, Pig

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Name: Speak, Alex

Major: Animal and Dairy Science

Faculty Advisor: Clay Cavinder, Animal and Dairy Sciences

Co-Author(s): Hannah Valigura

Funding: College of Agriculture and Life Sciences URSP

Effects of melatonin on inflammatory marker serum amyloid A in horses after exercise

Performance horses are regularly exposed to stressors (i.e., training and exercise) that negatively impact performance, potentially leading to increased oxidative stress (OS) and inflammation. Although important for the adaptive response, prolonged and unresolved OS/inflammation may decrease athletic performance or cause unnecessary cellular damage. Dietary supplements, such as antioxidants, can mitigate these negative effects. The study objectives were to evaluate the potential of the antioxidant melatonin to reduce Serum Amyloid A (SAA), a sensitive inflammatory marker, in horses after exercise. Horses ($n=6$) were randomly assigned to 2 groups (CON; $n=3$, no supplement or MEL; $n=3$, 20g melatonin). A switchback design consisted of 2 experimental trial periods lasting 14-d with a 30-d washout period in-between. Supplementation was given orally on exercise days. Horses underwent 1.5hr of moderate-intensity exercise (avg >90 BPM), 3 d/wk. Blood was drawn before exercise (PRE), and at 30- and 90-min post-exercise. After the washout period, the treatment (trt) groups were swapped; the study was repeated, resulting in 12 ED total. SAA ELISA kits (Thermo Fisher Scientific Inc., Massachusetts) were used to determine blood SAA concentration. All ED of each trial period was analyzed (ED1-6/ED7-12), and interactions of trt, time, and day were analyzed with significance set at ($P \leq 0.05$). PRE ED1 and 7 were set as baseline values, with no significant differences in baseline levels between groups ($P = 0.6879$). There was a trt*time interaction ($P = 0.0291$), with a significant difference between treatments at 30- ($P \leq 0.01$) and 90-min ($P \leq 0.01$) post-exercise on ED1-4, 7-9, and 12, with average plasma SAA concentrations being lower for MEL group. There was also a significant trt*day interaction for ED1-4, 7-9, and 12 ($0.0001 \leq P \leq 0.0376$) with MEL having lower SAA blood concentrations compared with CON. Lower concentrations of SAA in MEL horses suggests melatonin supplementation may reduce inflammatory blood markers and, therefore, may suggest reduced inflammation post-exercise.

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Name: Stewart, Mary Grace

Major: Psychology

Faculty Advisor: Mary E. Dozier, Psychology

Hoarding Severity and Correlation with Interconnectedness with Items and Others

Hoarding disorder is characterized by an excessive acquisition of items and difficulty or discomfort discarding possessions (American Psychiatric Association, 2022). People who show symptoms of hoarding disorder often feel interconnected with the items they find difficult to discard (Dozier et al., 2017). This study's purpose is to determine the level of association between hoarding severity,

interconnectedness with items, and interconnectedness with one's closest person. We hypothesized that hoarding severity would be positively correlated with interconnectedness with items, and hoarding severity would be negatively correlated with interconnectedness with one's closest person. To conduct these correlations, data was taken from a sample of 25 individuals with hoarding disorder. Of these 25 individuals, 76% identified as women and 24% identified as men. Eighty percent of the participants reported White as their race/ethnicity. All participants were ages 50-88, ($M=67.24$, $SD=9.26$) and lived in rural Mississippi. Hoarding severity was assessed using the Saving Inventory-Revised (SI-R). Interconnectedness with items was assessed using the Relationship with Self and Items (RSI). Interconnectedness with one's closest person was assessed using the Inclusion of Other in the Self (IOS). Pearson correlations were conducted between all measures. There was a significant positive correlation between SI-R scores and RSI scores ($r = .60$, $p < .05$). There was no significant correlation between SI-R scores and IOS scores ($r = -.32$, $p > .05$). Overall, hoarding symptoms significantly relate to individuals' feelings of interconnectedness with their items; however, in our sample, there was no significant correlation between hoarding symptoms and individuals' feelings of interconnectedness to the person they feel is closest to them. Limitations of this study include small sample size and limited geographical area of recruitment.

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Name: Stewart, Samuel

Major: Educational Psychology

Faculty Advisor: Mehdi Ghahremani, Counseling, Educational Psychology, and Foundations

Students' thinking styles and academic performance.

Many studies have been conducted on academic performance among undergraduate-level students. Nevertheless, previous work failed to address comparisons between academic performance and thinking styles. Therefore, this study has focused on undergraduate-level students' academic performance and their thinking styles. There were 239 students who fully completed this survey at a southern university. The purpose of this research is to analyze undergraduate students' academic performance. The survey data were collected using the Qualtrics platform, and contained five main components. These five components include a letter set, number series, questions about scientific reasoning, thinking styles inventory, and a brief demographic questionnaire. The results were analyzed using the statistical software SPSS to run a correlational analyses. The correlation analysis revealed that in this sample, no specific thinking style is significantly correlated with either the SAT or GPA; however, a conservative thinking style positively correlates to the student's academic performance through the ACT ($r = .153$; $p < .05$). Further research should include undergraduate students in a different region to examine the effects of thinking styles in college students from separate regions of the United States. *Keywords:* Academic performance, scientific thinking, thinking styles

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Name: Strong, Anna Catherine

Major: Human Development & Family Science

Faculty Advisor: JuYoung Lee, Human Sciences

Co-Author(s): Caitlin Willingham, Merritt Baker, and Caroline Walker

Generational Parenting Styles and their Effects on Mental Health

Over the past couple of years, studies have shown that parenting has changed, and mental health problems are at an all-time high. It is known that parents and their parenting styles are vital in the development of their children. Despite the perceived importance of parenting styles evolving over time and the increase in mental health problems, research gaps still exist in relating generational parenting styles and their effects on mental health. The logical consistency between mental health and parenting styles led to the hypothesis that each generation of parents uses a specific parenting style, ultimately influencing the development of anxiety and depression in their children. The authors will use Qualtrics to create a survey and compare the data using a t-test. Survey measurements of parenting styles (authoritative, authoritarian, permissive, and uninvolved) and mental health (anxiety and depression) from random participants (18 years or older) were compared. The Patient Health Questionnaire-9 (PHQ-9), Generalized Anxiety Disorder Assessment (GAD-7), and parenting-style questionnaires will be adopted. The data collected from the survey should show us what generation the participant's parents fall under, the severity of the participant's anxiety and depression, and what type of parenting style the participant grew up under. The overall results of the research are to see if each generation of parents uses a specific parenting style and if it influences the development of anxiety and depression in their children.

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Name: Taquino, Agatha

School: Starkville High School - MS Base Pair Program

Faculty Advisor: Harish Chander, Kinesiology

Co-Author(s): Hannah Freeman, Adam Knight

Funding: MS Base Pair Program

Postural Control Behavior in a Virtual Moving Room Paradigm

Introduction: Taking inspiration from the classical “moving room experiment” by Lee and Aronson (1974), a “virtual moving room paradigm (Vroom)”, to assess postural control behavior was designed using virtual reality (VR). **Methods:** Thirty healthy adults (age: 21 ± 1 years; height: 166.5 ± 7.3 cm; mass: 71.7 ± 16.2 kg) were tested for postural stability in a virtual moving room paradigm that consisted of randomized virtual, visual perturbations of the virtual room moving towards and away from the individual, during both unexpected and expected trials along with subjective experiences to VR and postural stability confidence were also assessed and analyzed using repeated measures analysis of variance. **Results:** Significantly lower postural sway in VR conditions, significantly greater postural sway during virtual room moving towards unexpectedly, and significantly improved balance confidence at $p < 0.05$ were identified. **Conclusions:** Findings indicate evidence of the virtual moving room inducing postural perturbations that challenge the postural control system, especially when the moving room is unexpected and towards the individual. Additionally, realistic immersion in the virtual environment with no adverse effects of simulator sickness and increased balance confidence was observed providing evidence for the beneficial effects of the Vroom. Thus, the Vroom can be an easy and cost-effective method to expose individuals to realistic, virtual, visual perturbations that challenge the postural control system and increase balance confidence without adverse effects.

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Name: Tharpe, Evan

Major: Aerospace Engineering

Faculty Advisor: Shreyas Narsipur, Aerospace Engineering

Co-Author(s): Ryan Premo, James Harsch, Michael Mangus

Midget Mustang Aerodynamic Winglet Design and Experimentation

The purpose of an aerodynamic winglet is typically employed on larger aircraft to decrease the induced drag by reducing the wingtip vortices caused during flight. Smaller aircraft, such as the Midget Mustang II, typically do not have aerodynamic winglets, therefore, it was the decision of the senior seminar design team to design, fabricate and operationally test aerodynamic winglets for the Midget Mustang II experimental class, homebuilt aircraft. The team’s goals are to optimize the geometry of the winglet thereby increasing the Lift-to-Drag ratio (L/D), minimize adverse effects to maneuverability and steady state flying stability of the airframe, and modeling the airfoil of the winglet section such that it generates a net aerodynamic force in the positive, or nose-forward, direction. This aerodynamic force will have the same effect on the aircraft as thrust. The methodology for designing the winglet consisted of first validating the teams modeling process in computational fluid dynamics software, ANSYS Fluent. Once validated, the team then built a Computer-Aided Design and Drafting (CAD) model of a sharklet-style blended winglet attached to the standard Midget Mustang II wing to be analyzed in ANSYS Fluent. The team also used MATLAB to calculate the aircraft’s stability and control as a result of aileron, rudder, and elevator input to ensure the addition of the winglet will not compromise performance. With all of this in mind, the team is standing by to fabricate the winglet, operationally test it in a manned flight test environment by measuring the fuel efficiency increase, and present experimental results.

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Name: Thompson, Annamarie

Major: Biomedical Engineering

Faculty Advisor: Trey Howell, Comparative Biomedical Sciences

Co-Author(s): Reagan McDevitt

Funding: National Institute of Environmental Health Sciences

Sex Dependent Effects of Organochlorine Pesticide Exposure on Diabetic Wound Healing

Diabetic foot ulcers are a common complication experienced by diabetics, affecting approximately 15% of patients. While the role of hyperglycemia and poor microvascular circulation in the pathogenesis of diabetic ulcers is well known, the effects of environmental exposures on wound healing deficits have not been previously explored. Therefore, the present study was designed to examine the role of exposure to prevalent organochlorine pesticide mixtures in diabetic wound healing and if sex dependent effects of these chemicals exist. To this end, we utilized a pressure-wounding model in normal C57BL6/J and diabetic Tallyho mice to simulate the development of diabetic ulcers. Prior to wounding, one group in each strain was treated with DTO 2 or corn oil to determine the effect these chemical compounds have on wound resolution. Following dosing, body weights were recorded and animals were subjected to two 12-hour pressure wounding cycles. After wounding was complete, images were taken on days 1, 4, 8, and 12 post wounding to measure wound area and perimeter to track wound resolution over a thirteen-day period. Animals were euthanized on day 13 post wounding to assess metabolic indices including serum glucose and triglyceride levels. Primary findings indicate a significant wound healing deficit between vehicle and DTO treated male Tallyho mice but no significant deficits in C57BL6/J male and female mice or Tallyho female mice. Additionally, significant differences in body weight exist between vehicle and DTO 2 male and female C57BL6/J mice and vehicle Tallyho male and female mice but not DTO 2 Tallyho male and female mice. Significant differences in plasma glucose and plasma triglyceride levels exist between female C57BL6/J mice and male Tallyho mice. These findings demonstrate pesticide exposure impacts diabetic wound healing and point to a need for further experimentation to determine why these deficits exist in males and not females.

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Name: Thompson, Charlotte

Major: Mechanical Engineering

Faculty Advisor: Matthew W. Priddy, Mechanical Engineering

Co-Author(s): James Wall, Lauren B. Priddy

Funding: Mississippi Space Grant Consortium (MSSGC)

Construction of a Gecko Toe Angle Detachment Device for Estimating Adhesion Forces Among Gecko Species

Gecko toepads are composed of setae, hairlike structures that allow geckos to run along surfaces with a vertical component. Setae interact with these surfaces through electromagnetic attraction, and this allows geckos to generate adhesion between their feet and the surfaces they walk on. Recent studies of gecko setae have been used to create new technology, such as modifying space suits for astronauts to mimic their adhesion effect. The "stickiness" of gecko toepads can vary across species, but the specific adhesion force that gives them their stickiness is unknown for many species. The adhesion force can be determined by measuring the maximum ratio of friction to adhesion of gecko toepads on a surface. To find this ratio, a prototype for a toe angle detachment (TAD) device was designed and built for researchers in evolutionary biology to study variations in gecko toepad adhesion amongst different species. The prototype was designed to rotate a gecko hanging on a glass slide away from vertical to determine the angle of toe detachment. In the past, mathematical models were used to calculate gecko toepad adhesion, though this method only considered ideal conditions where the shape of setae on gecko toepads is the same throughout the entire foot. These mathematical models do not compare well with real time observations because setae change shape along a gecko's toepad. This toe angle detachment device will allow researchers to conduct physical and repeatable experiments to find adhesion force among gecko species and compare their performance to draw evolutionary conclusions.

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Name: Thompson, Meghan

Major: Psychology

Faculty Advisor: Cliff McKinney, Psychology

Does Subjective Perception of Youthfulness Predict Reproductive Success?

Although the perception of physical attractiveness is subjective, research has shown that youths who are considered physically attractive are more likely to be socially and reproductively successful. Traits identified in previous research that increase the sexual selection in human reproduction are masculinity, somatotype, body symmetry, and height (in males). Age is also a considered factor when perceiving someone as attractive. Previous studies have shown that perceived age and physical attractiveness are negatively correlated. As perceived age increases, perceived attractiveness decreases. Research also demonstrates a higher agreement for what is considered an attractive female over what is considered an attractive male. The current study examined differences in reproductive success by examining relations between physical attractiveness and perceived age. The hypothesis stated that looking younger would increase the rate of reproduction and that feeling younger would not be a significant factor in reproductive success. Participants included 328 adults ranging from 34 to 84 years of age. The study consisted of three interviews (i.e., phone, questionnaire by mail, and in-person) as well as a follow-up phone interview conducted in six-month intervals. In the study, participants were asked two questions about how old they feel and how old they look (i.e., "I feel as though I am __ years old" and "I look as though I am __ years old."). Informed consent was obtained prior to assessment. Results indicated that feeling a certain age does not significantly impact reproductive success. Additionally, how old the participant looks does have a significant impact on reproductive success. In this study, looking younger increased the likelihood of reproductive success. Future research should continue to study the impact of physical attractiveness and perceived age on reproductive success and investigate other variables that have been shown to be related to attractiveness as well (e.g., facial expressions, hair color, skin color).

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Name: Tingle, Mary Beth

Major: Wildlife, Fisheries & Aquaculture

Faculty Advisor: Li Zhang, Poultry Science

Co-Author(s): Sabin Poudel

Funding: College of Agriculture and Life Sciences URSP

Investigating the Effectiveness of 405 nm Light in Controlling the Proliferation of Avian Pathogenic *Escherichia coli*

Avian pathogenic *Escherichia coli* (APEC) is a significant economic burden on the poultry industry. In recent years, control of APEC infection using antibiotics has been constrained due to widespread antimicrobial resistance. Recently, 405 nm light has been found to possess antimicrobial properties that are safe for both humans and animals. This study investigated the effects of 405 nm light in inhibiting the proliferation of APEC. Three experiments were performed with different distances and incubation temperatures to evaluate the effectiveness of 405 nm light in controlling APEC growth. In the first two experiments, APEC was placed in an incubator

exposed to 405 nm light at varying distances of 5 to 7 inches. The 405 nm light completely inhibited the growth of APEC in experiment one. However, it is unclear whether the inhibition of growth was due to the light or the combination of light and heat from the incubator. In experiment two, the temperature effect was removed, and there were no effects of 405 nm light on the growth of APEC at the tested distances. In the third experiment, the light was moved closer and APEC was placed under the 405 nm light at 1.5 inches apart at room temperature, where APEC growth was completely inhibited. Thus, the study concludes that the use of 405 nm light can potentially control APEC growth in close proximity. This approach is safe and cost-effective, making it suitable for different stages of poultry production, including hatchery sanitation and processing lines. The study's findings provide preliminary data for future projects exploring the use of this technology as an alternative to antibiotics in controlling pathogens in poultry production. Keywords: Poultry production, avian pathogenic *Escherichia coli*, 405 nm light, proliferation, antibiotic alternative

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Name: Townes, Davie

Major: Fashion Design & Merchandising

Faculty Advisor: JuYoung Lee, Fashion Design and Merchandising

Co-Author(s): Bailey Ainsworth, Cam Hatten, Natalya McNeil

How Dating App Usage Affects Mental Health Among Young Adults

Emerging adults using dating apps are experiencing mental health conflicts because they are either accepted by the opposite side or not, which is the other party swiping left or right in an instant manner. Recent studies measure how young adults' mental health is affected upon logging in because they can instantly see the other party's decisions, whether they are granted the stamp of approval with a "match" or not. Without traditional refusal, such as prolonged unresponsiveness, in dating decision-making, having access to instant results based on visual attributes can be detrimental to the emotional well-being for some young adults. However, little research investigates the relationship between dating app usage and mental health problems for young adults. This research aims to explore the relationship between mental health problems and dating app usage, specifically the effect of dating apps with a "swipe" feature. This research will clarify the relationship between self-esteem, anxiety, depression, and swipe-based dating app activity by surveying college students at Mississippi State University. With nearly half of the United States' young adults active on dating platforms, it is crucial to understand the impact of swipe-based dating platforms on the emotional well-being of young adults using online dating apps. For this study, the authors will use Qualtrics to create a survey, and correlation analysis will be conducted once the data is collected. Andreassen et al.'s (2012) Compulsive Use scale (4 items), Rosenberg's (1965) uni-dimensional scale (10 items), Hamilton's (1959) Anxiety scale (4 items), and Lovibond and Lovibond's (1995) Depression Anxiety Stress Scales (DASS) sub-scale (14 items) measures how young adults using Tinder benefits or disrupts their mental health. This study will provide information based on young adults' results when scrolling through Tinder to measure how lower rates of obtaining positive feelings would impact their mental health the most.

245

Name: Turnipseed, Sarah

Major: Microbiology

Faculty Advisor: Donna Gordon, Biological Sciences

Potential impact of *S. cerevisiae* ACT1 codon bias on occidiofungin sensitivity

Occidiofungin is a naturally derived product with broad spectrum antifungal activity shown to target the disruption of actin organization. In the budding yeast, *Saccharomyces cerevisiae*, actin is encoded by a single essential gene, *ACT1*. Actin protein levels within yeast are regulated with overexpression shown to negatively impact growth. Actin protein folding is an additional actin regulatory step and is dependent on the activity of the CCT chaperone complex. Analysis of codon usage patterns in *ACT1* using the %MinMax online calculator identified that codon usage frequencies were more common than average across the gene except for codons 71-78 which fell just below average. Given the potential influence that these low frequency codons may have on translation rate and protein folding, we aimed to determine whether synonymous replacement of low frequency codons within *ACT1* leads to alterations in actin-based activities including sensitivity to actin targeted compounds such as occidiofungin. To test this, a plasmid was generated by homologous recombination that placed the codon optimized *ACT1* gene (*ACT1_{co}*) downstream of the *ACT1* promoter. The plasmid was introduced into our haploid *ACT1* shuffle strain and the covering wildtype *ACT1* plasmid removed with growth on 5-FOA plates. Functionality of *ACT1_{co}* was tested by spotting assay to monitor cell growth and susceptibility assay to measure differences in sensitivity to occidiofungin. In both assays, *ACT1_{co}* expressing cells behaved identical to cells expressing wildtype *ACT1*. These findings suggest that the low frequency codons identified in *ACT1* likely have minimal impact on the rate of translation and protein folding.

143

Name: Umar, Muneebah

Major: Biological Sciences

Faculty Advisor: Molly Zuckerman, Anthropology and Middle Eastern Cultures

Co-Author(s): Lauren Nichols, Kerri Widrick, Cassandra DeGaglia, Amanda Wissler, Aleisha Reynolds, Fabian Crespo, Sharon DeWitte

Funding: ORED Undergraduate Research Program, NSF Senior Research Grant, NSF EAGER, Shackouls Honors College Presidential Scholarship

Examining frailty relative to persistent late-stage acquired syphilis infection in individuals within a historical documented collection

The many complexities of clinical and microbiological research on acquired syphilis (*Treponema pallidum pallidum*) (e.g., limited animal models) mean that scientific understandings of its pathogenesis, especially progression to tertiary (late) stage infection relative to human host characteristics and heterogeneity in frailty, has lagged behind that of other common bacterial infections. With rising incidence, syphilis is also a reemergent public health problem. To circumvent some of the complexities, we assessed frailty relative to late-stage infection in a preliminary sample (N=20; combining individuals from the Robert J. Terry Anatomical Collection and the Hamann-Todd Osteological Collection (HTOC) to increase sub-sample size) of skeletal individuals with antemortem diagnoses of syphilis, with sub-samples of individuals with late (n=15) and early stage (primary, secondary) (n=5) infection. We applied a 5-biomarker Skeletal Frailty Index (SFI) (Periodontal disease, PH, CO, LEH, Osteoporosis). We predicted lower frailty—and inferred higher immunological competence—in those who did not progress past early-stage, but higher frailty—and lower immunological competence—in those who progressed to late-stage. Preliminary results are consistent with this hypothesis, with a lower SFI (1.6) amongst early-stage individuals compared to late-stage (1.92), though this is insignificant, likely due to small sample size (Mann-Whitney U test ($p = 0.416$)). These results may indicate that elevated stress facilitated persistent infection. Deeper understanding of frailty relative to destructive and debilitating late-stage syphilis may improve reconstructions of syphilis's past disease burden but also, via translational science, contribute to refined prognostic, diagnostic, and screening criteria in public health and clinical settings.

42

Name: Usey, Timothy

Major: Electrical Engineering

Faculty Advisor: Seungdeog Choi, Electrical and Computer Engineering

Co-Author(s): Tahmid Ibne Mannan

Funding: Office of Naval Research

Development of a Line Impedance Stabilization Network (LISN) Design for High Voltage Applications

Line Impedance Stabilization Networks, or LISNs, are crucial for repeatable electromagnetic interference (EMI) measurements by providing a precise and stable line impedance. Despite high voltage electronic systems such as those found in electric vehicles becoming more common, there are not commercially available LISNs able to process the high voltages, generally in excess of 1kV, needed to conduct experiments on behavior such as EMI on said electronic systems. To address this problem, our team has developed an original design for a LISN able to handle voltages up to 1.5 kV and frequencies up to 40 MHz. This design has utilized capacitors and inductors of new parameters, as well as using a novel schematic and expanded inductor winding gaps to reduce the parasitic behavior of these components at the high voltages that limit commercial LISNs from operating at voltages above 1 kV. Along with the economical nature of our design, our LISN's measured EMI noise characteristics are comparable to commercial LISNs, meeting both CISPR and MIL-STD EMI standards. The new LISN design will be very useful for EMI noise measurements for above 1 kV, which will be necessary for conducting EMI tests on electric vehicles and similar machines. As this LISN design holds great potential for contributing to the design of high voltage electronic systems, we look forward to increasing our maximum operable frequency in the near future.

246

Name: Van, Dustin

Major: Computer Science

Faculty Advisor: Vitor Souza Martins, Agricultural and Biological Engineering

Funding: ORED Undergraduate Research Program, MS NASA RID (award n: 23-12-12)

Improving Water Quality Monitoring through NASA Landsat-9 images using a Deep Learning Approach

Aquatic systems play a crucial role in water supply, food production, and energy generation. Despite the importance, anthropic activities have promoted the eutrophication of water, caused by the increase in the concentration of nutrients, and consequently in the flowering of algae blooms. The monitoring of these environments is relevant for public health, and remote sensing emerges as a data source for spatiotemporal information of water quality parameters. This research seeks to develop a method for predicting chlorophyll-a concentrations from Landsat 9 satellite imagery using a neural network. To achieve this, a dataset of 7,572 hyperspectral remote sensing reflectance measurements, along with the co-located water quality measurements, was collected through the GLORIA project. The next

step involved simulating the hyperspectral remote sensing reflectance measurements from a satellite's view, whereby these values were corresponded to each band of a Landsat 9 satellite sensor. Finally, a neural network was trained using the simulated spectra values from the satellite view and chlorophyll-a measurements, with the aim of predicting chlorophyll-a concentrations from Landsat 9 satellite imagery. The results of this study provide a valuable tool for remotely monitoring chlorophyll-a concentrations in water bodies, which is important for providing an efficient and cost-effective approach to understand the dynamics of aquatic ecosystems and manage water resources.

247

Name: Van Epps, Emma

Major: Biomedical Engineering

Faculty Advisor: Lauren Priddy, Agricultural and Biological Engineering

Funding: Industrial and Systems Engineering REU stipend for UG researcher

Bioprinting Parameter Optimization for Polymer-Ceramic Composite Scaffolds for Bone Tissue Engineering

Critically sized bone defects resulting from trauma or tumor resection present a significant challenge to healthcare providers due to bone tissue's limited self-healing ability. Autografting, the current gold-standard treatment for bone defects of this magnitude, is invasive, costly, and prone to donor site morbidity. To address these limitations, biomaterial scaffolds can be designed to mimic native bone's mechanical and biological properties to promote tissue regeneration. Such porous scaffolds should: 1) provide sufficient strength to withstand repeated compressive loading, and 2) have a degradable bioactive surface with interconnected pores to facilitate osteoblast attachment and proliferation. Therefore, the scaffold's porous structure is critical to its osteoconductivity. However, traditional scaffold fabrication methods have limited capacity for creating precisely customized porous structures. 3D printing, a relatively new bone scaffold fabrication technique, enables customizable scaffold structures (including pore size, shape, and interconnectivity) and material properties (via composite materials). Accordingly, there is an urgent need to characterize the strut thickness and pore size of the printed scaffolds, to evaluate the geometric accuracy compared to the as-designed geometry. In addition, the printing parameters (extrusion pressure, printing speed, and temperature) and their impact on the geometric accuracy need to be understood. In this study, polylactic-co-glycolic acid (PLGA) and nanohydroxyapatite (nHA) were combined to create a composite material for mimicking native bone properties. A fused deposition modeling (FDM) 3D printer with a camera toolhead was used to fabricate scaffolds with cubic pores of 750 microns while capturing layer-wise images, to evaluate geometric accuracy and assess the effects of the printing parameters. Both scaffold strut width and layer adhesion are highly dependent on printing temperature. Modification of the g-code software and accessory pieces enhanced geometric accuracy. 3D printing of bone scaffolds comprising composite materials may allow scaffolds to be tailored for patient-specific bone defect treatment.

248

Name: Venarske, Nate

Major: Biomedical Engineering

Faculty Advisor: Vitor Martins, Agricultural and Biological Engineering

Mapping Plant-Insect Interactions with iNaturalist Data from Mississippi

Flower visitation is one of the most important plant-animal interactions in ecology, as the preferences of flower visitors mediate plant pollination. An understanding of floral preferences can inform the ecology of insect-pollinated invasive plants and the life history of insects of conservation concern. The floral preferences of Mississippi flower-visitors were studied using secondary data from the citizen science database iNaturalist. Photos of flower-visitors were annotated with the associated plant, and the data were visualized with an ArcGIS Dashboard. Insect community composition was observed to vary by month, county, and EPA Level IV ecoregion. The observations spanned from 1987 to 2022 and represented more than 7000 individuals from 5 orders and 45 families. iNaturalist secondary data is an untapped resource for flower-visitation studies. This work demonstrates that state and regional ecological studies can be conducted using iNaturalist data. Future studies should use iNaturalist's more than 4 million observations of 16,000+ insect species, which include almost 2 million observations of 4000+ Lepidoptera species, 5000+ observations of almost 2000 Hymenoptera species, and more than 4000 observations of 400+ beetle species.

249

Name: Vu, Judy

Major: Biological Sciences

University: Louisiana State University

Faculty Advisor: Juhee Haam, Biological Sciences, LSU

Investigating the role of the temporoammonic pathway (TA) in the hippocampus in memory formation using a chemogenetic and behavioral approach

Through examination of the role of the entorhinal cortical neurons and the temporoammonic pathway neurons using chemogenetics and rodent behavioral testing, the results may indicate whether the TA pathway is necessary for memory consolidation. In the entorhinal cortex lies the temporoammonic neuron, which transmits signals to the hippocampus. When injecting mice with the vector HM4DI, which is a DREADD approach, neuronal silencing occurs through inhibitory effect. Cre recombination occurs in the hippocampus where plasticity and memory formation occurs. By suppressing temporoammonic neurons in Cre-lox mice using the drug, CNO, the necessity of the TA pathway in memory consolidation can be determined through rodent behavioral testing.

250

Name: Wade, Lynn

Major: Biochemistry

Faculty Advisor: Seung-Joon Ahn, Biochemistry, Molecular Biology, Entomology, and Plant Pathology

Funding: College of Agriculture and Life Sciences URSP

Morphology, Behavior, and Life Cycle of the Hibiscus Sawfly, *Atomacera decepta* (Hymenoptera: Argidae)

Atomacera decepta, commonly known as the hibiscus sawfly, is considered a minor pest, but it feeds on the foliage of several ornamental plants, including hollyhocks, rose mallows, and some other Hibiscus plants, turning it into lacy skeletons of leaf veins. Such a voracious appetite of the sawfly is an interesting mode of feeding among different herbivorous insects. However, little is known about this insect species. The purpose of this research was to collect basic data on its morphological and behavioral characteristics and to provide a better understanding for future research. Discovering characteristics of *A. decepta* has been performed through a few experiments. (1) Observations of live sawflies in the natural habitat as well as in the lab were conducted to grasp their basic behaviors and life cycle. (2) Morphological features of larvae and adults were investigated by microscopic examinations including scanning electron microscopy (SEM). (3) The larvae were dissected to connect organs to functions such as feeding, defense, and reproductive mechanisms. (4) Finally, the whole-body transcriptomes were obtained by Illumina NovaSeq 6000 for the comparison of gene expression between adult male, adult female, and larvae. Future investigations on the digestive and detoxifying enzymes in larvae and the reproductive hormones in adults will be explored in detail. As a result, this project has provided clearer information about this little-known insect, but, at the same time, gave an opportunity for more questions to be addressed. A basic understanding of *A. decepta* characteristics would pave a way for future research on its digestive physiology and defensive chemistry.

144

Name: Walden, Matilyn

Major: Psychology

Faculty Advisor: Cliff McKinney, Psychology

The Moderation of Religiosity on the Relation Between Maltreatment and Psychological Problems

Previous research suggests that maltreatment is a strong predictor of psychological problems across the lifespan. The current study examined emerging adult religiosity as a coping strategy that moderates the relationship between past-year maltreatment and psychological problems. It was hypothesized that higher level of religious coping would result in a weaker relation between maltreatment and psychological problems. Participants (N = 583) reported their experience of current maltreatment by parents (Conflict Tactics Scale: Parent-Child Version; Straus et al. 1998), religious coping (Assessment of Religious Traits; Stearn & McKinney, 2018), and total psychological problems (ASEBA Adult Behavior Checklist; Achenbach & Rescorla, 2003). Religious coping had a negative association with psychological problems in women and men. It also moderated the relation between paternal physical maltreatment and psychological problems. Among women who reported higher religious coping, the association between paternal physical maltreatment and total psychological problems was zero. Conversely, women who reported lower religious coping, this relation was positive. Overall, results suggested that high religious coping in women might buffer the harmful effect of paternal physical maltreatment. Practical implications might include improving intervention for ongoing maltreatment in adulthood. Those seeking to process the harmful experience of parental maltreatment might find progress in coping through religion if relevant to the particular individual. Future research should conduct studies where specific religions are represented as well as more specific forms of maltreatment and psychological problems such as depression and anxiety.

145

Name: Waller, Mary Marshall

Major: Biological Sciences

Faculty Advisor: Mary Nelson Robertson, School of Human Sciences

Co-Author(s): Holli H. Seitz, and Michael R. Nadorff

Funding: Rural Health and Safety Education Grant No. 2020-46100-32841

Suffering in silence: Does perceived accessibility influence rural adults perceived likelihood to engage in mental health fostering behaviors?

Background: Rural areas in the United States face distinguishable mental health professional shortages. This study measures rural Mississippi adults' perceived accessibility to behaviors that foster mental health and their perceived likelihood to seek mental health resources and a mental health professional if dealing with a mental health challenge. Methods: Rural Mississippi adults were recruited via an online survey panel to complete a 147-item web-based questionnaire. Results: Nearly half (49.8%) of participants reported talking to a therapist or counselor as somewhat to very accessible. Approximately half (50.8%) of respondents reported being somewhat to very likely to seek a mental health professional if dealing with a mental health challenge. A positive correlation was found between perceived accessibility to talk to a therapist or counselor and perceived likelihood to seek a mental health professional, $r_s(226) = 0.359$, $p < .001$. Almost two-thirds (65.7%) reported improving access to Telehealth as somewhat to very helpful in addressing mental health challenges in their community. Conclusions: Results suggest that perceived accessibility to mental health fostering behaviors increases as perceived likelihood to seek a mental health professional increases. Therefore, increased accessibility to mental health professionals is imperative to increase the utilization of mental health professionals. Additionally, results suggest that rural adults perceive telehealth as a helpful tool in addressing mental health challenges in their community. Considering telehealth may increase access to mental health professionals, there is also potential for an increase in the number of individuals who would seek mental health professionals if dealing with a mental health challenge. Using Telehealth services in rural Mississippi, however, would necessitate equipping urban mental health professionals with the education to treat rural populations. Future research should examine the relationship between access to telehealth and likelihood to seek mental health professionals as a resource if dealing with a mental health challenge.

251

Name: Walters, Jordan

Major: Microbiology

Faculty Advisor: Mark Welch, Biological Sciences

Co-Author(s): Zach Dykema

Genetic structure of a translocated population of the endangered Turks and Caicos rock iguana (*Cyclura carinata*) at Six Hills Cay.

We seek to assess genetic variation in a translocated population of the endangered Turks and Caicos rock iguana (*Cyclura carinata*). Small islands have limited resources, and populations of terrestrial vertebrates will have low census population sizes as a result. Small population size should correlate with a limited gene pool. Hence, small populations often exhibit low genetic variation. However, newly established translocated populations should exhibit similar levels of genetic variation to that present in the source population used as genetic stock for their establishment. To assess whether the establishment of a translocation was a success from a genetic perspective, genetic variation on Six Hills Cay, the translocated population of *C. carinata*, was compared to that on Big Ambergris Cay, the source population. We used 29 microsatellites and fragment analysis to genotype 86 iguanas across multiple generations. F-statistics and allele frequencies were calculated using GenALEX. This research helps determine how much genetic variation persists in a small, translocated population. Translocation has become a popular tool among conservationists. Hence, research supporting the efficacy of translocations is warranted.

252

Name: White, Emily

Major: Forestry

Faculty Advisor: Courtney Siegert, Forestry

Co-Author(s): Drew Williams

Funding: ORED Undergraduate Research Program

Carbon Sequestration Potential of Non-Commercial Tree Species in the Southeast

Landowner participation in carbon exchange markets has become increasingly popular in the southeastern U.S. Advances in the knowledge of species-specific carbon storage are critical for development of accurate carbon quantification. Woody debris is a major component of the global carbon cycle, and the decomposition of wood is affected by the quality of substrate, climate, and the type and abundance of decomposer organisms. However, variation among tree species is a major factor affecting decomposition and long-term carbon storage that is not well known. To address this knowledge gap, a field experiment was initiated in 2021 to test the decomposition rates across several common, but silviculturally unimportant, species that exist on the landscape, with the goal of identifying species with desirable traits to facilitate long term carbon storage. Preliminary analysis found that wood density could be an indicator of sequestered carbon. Species density ranges from hickory, the densest with 0.939 g/cm³ on average, to eastern redcedar, the least dense with 0.465 g/cm³ on average. However, the species that has the highest percent density loss after 6 months of decomposition was white oak (15%) while the species with the least change in density was loblolly pine (3.5%). Carbon loss data are pending, along with 12-month decomposition data. Results from this study could offer species-specific area options for optimizing carbon sequestration in managed forest.

66

Name: Wilbert, Karter

Major: Foreign Language

Faculty Advisor: Sol Pelaez, Classical and Modern Languages and Literatures

No tener límites: La monstruosidad de Susy Shock

This abstract is about Argentinian, transgender artist and activist, Susy Shock, and her works. In a heteronormative environment, a transgender person's ability to exist is very significant. To be transgender requires the ability to navigate the societal rules of femininity and masculinity, but Susy Shock does not adhere to these limitations. Her perpetual existence outside of societal norms creates what Shock proudly calls her monstrosity, which she uses to empower herself and the trans community. Because Susy Shock does not "pass" or conform to traditional femininity, her monstrosity breaks and recreates gender roles and appearances. Her work "Milonga Queer" conveys themes of "transness" and autonomy to communicate ideas about femininity and masculinity that contradict heteronormative standards. These themes reinforce her message by revealing her blatant disregard to obey binary models of gender. Accordingly, the article, *Lo Escénico Como Negatividad Subversiva: Ajenidad Radical y Performance Trava Sudaca En La Voz De Susy Shock*, by Ariel Martinez and Ana Sabrina Mora, discusses Shock's monstrosity and how she manipulates her monstrosity to push past gender limits and shatter social standards. Unlike the previous article, Joseph M. Pierce's article, *I Monster: Embodying Trans and Travesti Resistance in Latin America*, looks at the reality of oppression and "transness" in Latin American countries. However, both articles expand on Shock's "transness" and monstrosity in her life, and the topics support the active use of Shock's monstrosity to undo assigned gender roles, stereotypes, and assumptions. Shock's monstrosity disturbs heteronormative ideas about femininity, masculinity, and gender roles. *Note: Research was originally done in Spanish except for the academic articles used*

253

Name: Wilburn, Jordan

Major: Biochemistry

Faculty Advisor: Richard Baird, Biochemistry, Molecular Biology, Entomology, and Plant Pathology

Funding: College of Agriculture and Life Sciences URSP

Temporal Study of the Metabolites in Two Soybean Cultivars Using NMR

Soybeans (*Glycine max* (L.) Merr.) are a vital crop globally and a significant component of the United States' agricultural production. However, global warming and the increase in atmospheric greenhouse gasses such as carbon dioxide are expected to cause extended periods of high temperatures and periodic drought, resulting in plant stress, cellular damage, and potentially greater susceptibility to plant pathogens. These epigenetic factors each pose unique challenges to the cultivation of healthy and abundant soybeans which are at present are not adapted to the new conditions. When under stress, plants utilize altered metabolic pathways to maintain homeostasis, resulting in varied metabolite concentrations in cells in response to different environmental conditions. The goal of this research is to examine the metabolomes of soybean plants under several abiotic stress conditions. A soybean growth study using a sunlit, highly controlled growth chamber system was conducted by Dr. Reddy's research group using two soybean cultivars (one of which is classified as heat tolerant) under various environmental conditions. Using tissue from this study, a secondary study was conducted to evaluate the metabolome of the plants under these different environmental treatments by harvesting leaves from the soybean plants across three dates: before the experimental conditions were applied, several weeks afterwards, and then prior to senescence. An untargeted metabolomics analysis was conducted using 500 MHz nuclear magnetic resonance (NMR) machine and the Chenomx NMR Suite software to identify and analyze the concentrations of metabolites present in each sample. By comparing concentrations across experimental groups, this study not only assesses variations in metabolite concentrations temporally, but also provides insight into the metabolic mechanisms that may provide stress tolerance to soybeans and support future molecular breeding. The resultant NMR metabolite occurrence and concentration by environmental treatment data and statistical analyses are presented in the poster.

254

Name: Williams, Alyssa

Major: Biochemistry

Faculty Advisor: Henriette van Praag, Biomedical Science at Florida Atlantic University

Funding: Summer Integrative Neuroscience Experience (SINE) hosted at Florida Atlantic University

Neuronal differentiation across time points in an Alzheimer's Mouse Model

The dentate gyrus is a region of the hippocampus that plays an important role in memory discrimination, and it is one of only two regions of the mammalian brain that is believed to generate new neurons into adulthood. A growing body of evidence suggests adult neurogenesis persists throughout human life, though it declines with age and is greatly impaired with Alzheimer's. This project aims to track the physiological changes in the dentate gyrus between Wild Type (WT) mice and Alzheimer's mice at early and late pathologic states to validate the progression of neurogenic impairment in the APP/ps1 mouse model. Using immunohistochemistry, BrdU injected

at 5 months and DCX perfused at 10 months was compared to examine neuronal differentiation and physiological differences in the dentate gyrus. Though data collection is not complete, a greater difference between the WT control and the Alzheimer's mice is expected to be observed in the DCX staining. To truly validate the neurogenic impairment in the APP/ps1 Alzheimer's mouse model, future studies should incorporate NeuN antibody staining in addition to BrdU to specify neurons and their development in the dentate gyrus.

255

Name: Willis, Emma

Major: Biochemistry

Faculty Advisor: Shien Lu, Biochemistry, Molecular Biology, Entomology, and Plant Pathology

Co-Author(s): Stephen Westin Phillips

Funding: College of Agriculture and Life Sciences URSP

Identification and Characterization of Bacterial Isolate WP18 from the MS Delta

Plant disease is one of the major factors to affect crop production worldwide. The use of antimicrobial bacteria as a biological control agent is becoming more popular as society moves away from the use of chemicals and towards the use of natural pesticides. The research objective of this project was to identify bacterial strains for biological control. Bacterial isolate WP18 was isolated from a soil sample associated with a soybean plant root system collected from the MS delta. The isolate showed promising antimicrobial activity. 16s rRNA sequencing analysis showed that the bacterial isolate belongs to the genus *Pseudomonas*. Further genomic analysis is under way to identify the species. The isolate showed strong antibacterial activity against both Gram positive and Gram negative bacteria, such as the pear fire blight pathogen *Erwinia amylovora* 2029, the soil bacterium *Bacillus megaterium* Km, and vegetable soft rot pathogen *Pectobacterium carotovora* subsp. *carotovora* Ec101. It was hypothesized that this isolate could exhibit significant antifungal activity, which is under way to be investigated. In addition, the WP18 genomic DNA was prepared for genome sequencing. Genome wide analysis of genetic loci related to antimicrobial activity will be conducted. This bacterial isolate shows promise for use as an antimicrobial agent in plant disease management. This research will provide important insights into the development of biopesticides.

43

Name: Witcher, Jacob

Major: Aerospace Engineering

Faculty Advisor: Shreyas Narsipur, Aerospace Engineering

Co-Author(s): Shuvam Saha

Measurement of Aerodynamic Loads Using Optical Fiber Sensing

A relationship can be drawn between aerodynamic loads caused by fluid pressure and shear experienced during flight and strain on the aircraft structure. By measuring surface deflections along the aircraft wing during flight, we can extract the values of the aerodynamic loads being experienced that are causing those deflections. Optical fiber strain-sensing cable is being used in two different ways: along the chord of the wing and along the wingspan. These two methods are being used to determine which will predict the aerial loads as well as what loads are being captured. The cable itself detects strain, which can be converted into different aerodynamic loads based on the direction the cable is oriented. Along the chord of the wing, the optical fiber cable will detect pressure and shear. In the span-wise direction, the cable will directly measure the force distribution. Experiments are being conducted in a wind tunnel to obtain data verify this hypothesis.

256

Name: Wright, Jamarah

Major: Animal and Dairy Science

Faculty Advisor: Derris Devost-Burnett, Animal and Dairy Sciences

Co-Author(s): Kristian Jones, Ryen Greer, Kenisha Gordon

Funding: College of Agriculture and Life Sciences URSP

Effect of Leafy Vegetables vs Pellet Diets on the Growth Performance of Rabbits

In recent years, rabbits have become an increasingly viable source of animal protein, having a similar protein content to meats like beef, pork, and chicken. Rabbit meat is also an abundant source of vitamins and minerals, and has much lower cholesterol content than any of the other commonly consumed meats (USDA, 2019). As a result of the increasing viability of rabbits as an animal protein source, there is a critical need for empirical data to optimize strategies to maximize feed efficiency and growth performance of meat rabbits for the growing meat rabbit industry. Therefore, this study was conducted to assess the impact of diet formulation on the growth performance and efficiency of growing meat rabbits. A total of 16 cross-bred rabbits weaned at seven (7) weeks of age were randomly allocated into two experimental groups. The first group, consisting of seven (7) kits, was fed a 150g basal diet of commercial pellets,

while the second group, consisting of nine (9) kits, was fed a 200g treatment diet containing apples, cilantro, carrots, lettuce, and radishes. Both groups were allowed *ad libitum* access to water and bermudagrass hay. The experiment was conducted for four (4) weeks with an adaptation period of seven (7) days to allow the rabbits to reach a common time endpoint. To assess the effects of the experiment accurately, proximate analysis was performed on both diets. It was observed that the pellets contained higher amounts of protein and crude fiber compared to the fruit and vegetable mix. Therefore, since the pellets have a more balanced ratio of nutrients, it was hypothesized that rabbits that consumed the pelleted ration would have greater growth performance and feed efficiency.

146

Name: Wright, Jeremy

Major: Kinesiology

Faculty Advisor: Chih Chia Chen, Kinesiology

Co-Author(s): Andrew McBryde

Physical Activity Behaviors in College Students: Comparison Between Kinesiology and Non-Kinesiology Majors

PURPOSE/AIM: The Transtheoretical Model of Change applied to exercise behavior is a model that consists of the following five stages: Precontemplation, Contemplation, Preparation, Action, and Maintenance. By merging the perspective of the transtheoretical model, the purpose of the study was to understand whether education plays an important role, specifically the influence of the Kinesiology curriculum on college students' physical activity behaviors. **METHODS:** By collecting a sample size of 521 Mississippi State students (268 Kinesiology majors (CLEP concentration), 253 non-Kinesiology majors), aged 18-30, we measured self-reported body mass index (BMI), leisure-time moderate-to-vigorous physical activity levels (MVPA), self-efficacy levels (SE), and decisional balance (Pros and Cons toward exercise), and stage of change in an online survey. **RESULTS:** Based on the survey's results, BMI was negatively associated with MVPA and positively associated with Cons. SE was positively associated with Pros and negatively associated with Cons. MVPA was positively associated with SE as well as Pros. In contrast to non-Kinesiology majors, Kinesiology majors had lower BMI, participated in higher MVPA levels, expressed higher SE, and valued exercise more positively. **IMPLICATIONS/CONCLUSION:** The results of this study show that the current Kinesiology curriculum may give students more knowledge of ways to apply that knowledge to their daily lives and motivations to exercise. For example, individuals who are at the advanced stages of the Transtheoretical Model of Change showed higher self-efficacy and valued exercise more positively. Additionally, BMI and SE seemed to influence how college students evaluate exercise. To best promote public health in college students, this study suggests that general education curricula may offer more relevant physical activity and health classes to college students.

147

Name: Yankelevich, Michelle

Major: Psychology

Faculty Advisor: David May, Sociology

Funding: ORED Undergraduate Research Program

Breaking the Cycle: The Intersection of Recidivism, Monetary Sanctions, and Prisonization in the U.S. Criminal Justice System

A large body of research has examined the relationship between recidivism and poverty. Yet, despite this attention, the interplay between recidivism, monetary sanctions, familial impact, and the cycle of repeat offending remains poorly understood. This knowledge gap has hindered the development of effective policies and interventions that intend to break this cycle. To address this issue, further research is needed to explore the underlying mechanisms of this cycle to identify effective strategies that may mitigate the negative impact of monetary sanctions on families of incarcerated individuals, thus reducing the likelihood of repeat offending. Recent research suggests that monetary sanctions may increase the likelihood of recidivism, trapping individuals within the criminal justice system and exacerbating the poverty-crime cycle. This systematic review of the literature further highlights that economic sanctions disproportionately impact low-income and nonwhite individuals. However, alternative forms of punishment and re-entry programs offer potential solutions to break this cycle. These programs prioritize rehabilitation and social support over punitive monetary sanctions. This systematic review underlines the need for policies that prioritize rehabilitation and support to break the cycle of poverty and crime, creating a more just and equitable society.

44

Name: Yee, Justin

Major: Computer Science

Faculty Advisor: Jingdao Chen, Computer Science and Engineering

Co-Author(s): Prabesh Khanal, Amanuel Tesfaye

Funding: National Science Foundation (NSF)

Digital Twin Creation in Off-Road Environments from LiDAR Scans

Digital twins are digital representations of real objects whose purpose is to allow simulation and testing in a virtual interface. Recreation of mapped and structured environments such as roads and buildings in response to the development and integration of autonomous vehicles and city planning have already seen extensive research. However, the usage of digital twins in regards to off-road environments such as forests, farms, and mountainous areas is still poorly studied. This research project seeks to create and study digital twins of off-road environments with a focus on modeling terrain and vegetation. Point cloud maps of the environment are constructed from Velodyne LiDAR scans taken from a Clearpath Husky UGV using Simultaneous Localization and Mapping (SLAM). The point clouds are processed by ground segmentation to extract the ground terrain from the point clouds and Euclidean clustering to group the remaining points into clusters of trees and other vegetation. Ground points are used to build an elevation map modeling sloping terrain, ditches, and gullies. Poisson meshing was used to convert the tree and vegetation clusters into meshes stored in OBJ format. The terrain and vegetation data is stored in a .json file containing the position and orientation of the objects and are loaded on to the Mississippi State University Autonomous Vehicle Simulator (MAVS) to be reconstructed in a digital environment. The proposed project has a wide range of applications including virtual autonomous vehicle testing, synthetic data generation, and training of AI models.

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Relationship Between Long-Term Participation in Creative Hobbies and Depressive Symptoms in Older Adults

Creative hobbies have been explored in their connection to positive impacts on mental health. Robert Stebbins created the term 'Serious Leisure' to define hobbies that are especially important to individuals (Stebbins, 2006). Creative hobbies that are considered serious leisure for people have been found to have positive impacts on mental health, but the underlying mechanisms explaining this relationship are not quite understood (Israel et al, 2020). The current study examined if there was a relationship between how long an individual has been participating in creative hobbies along with how closely they identify with their creative identity and depression in older adults. Previous research performed in relation to this topic found that there was a decrease in depression symptoms after participation in creative hobbies, therefore similar results are expected for participation in hobbies without a therapeutic aspect (Bone et al., 2022). The study included 311 participants (M = 60.04 years) found in Facebook groups for creative hobbies. In the survey, participants completed the CESD-R to measure the participants' depression symptoms. Using a multiple regression test, the results of this study concluded there was a significant relationship between lower depression and creative identity. However, the amount of time spent was not necessarily helpful within this relationship. This is consistent with work done by Robert Stebbins in establishing the importance of serious leisure. This study highlights the importance of exploring the relationship between mental health and creative hobbies in older adults.



UNDERGRADUATE RESEARCH AND CREATIVE DISCOVERY

The Office of Undergraduate Research and Creative Discovery at Mississippi State University works to support undergraduate research and creativity by connecting students with opportunities aligned with their intellectual interests and guiding them through the process of completing successful undergraduate projects. Our newly designed website offers resources for both students and faculty mentors: urcd.msstate.edu

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